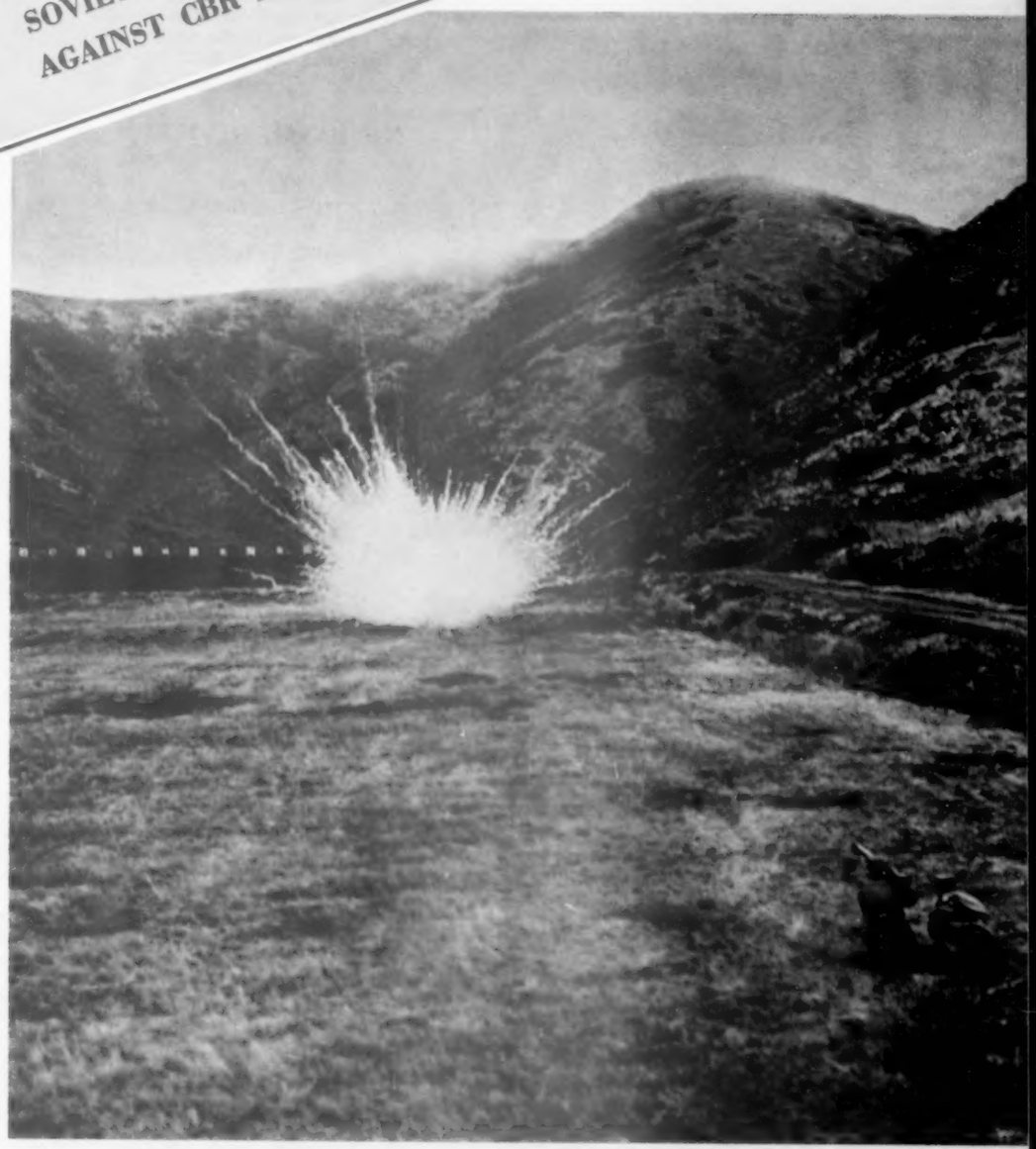
ARMED FORCES CHEMICAL JOURNAL

In This Issue—
SOVIET CIVIL DEFENSE AGAINST CBR ATTACK



MAY-JUNE 1959

ARMED FORCES CHEMICAL ASSOCIATION

National Headquarters

408-410 Park Lane Building—2025 Eye Street, N.W.

WASHINGTON 6, D.C.

(Republic 7-6803)

The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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POLICY

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

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FRONT COVER

(U.S. Army Photo)

Speaking of guided missiles, we should not forget that highly versatile and useful missile weapon of the World War II foot-soldier, the 2.36" rocket and launcher known as the Bazooka. Essentially an antitank weapon, there was, however, a chemical smoke shell—WP—provided for it, as depicted here on a training range in California. A larger and more powerful rocket and launcher (3.5") has since been provided.

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AFCA AFFAIRS

PINE BLUFF CHAPTER HEARS ARKANSAS PUBLICITY DIRECTOR

Pine Bluff Arsenal Chapter, Armed Forces Chemical Association, held a dinner at the Officers' Open Mess on 17 February 1959, at which Mr. Ted Woods, executive director, Arkansas Publicity and Parks Commission, was the principal speaker.

In the picture of the head table herewith—left to right, facing camera—are: Mr. J. W. Shackelford, Pine Bluff Arsenal plant manager, Arkansas-Louisiana Chemical Corporation; Mr. C. J. Maupin, deputy commander, Pine Bluff Arsenal; Mr. W. J. McCanless, assistant personnel director, Pine Bluff plant, International Paper Company; Col. Russell W. Dodds, commanding officer, Pine Bluff Arsenal; Mr. Woods; Mr. Conrad Hardy, acting president, Pine Bluff Arsenal Chapter, Armed Forces Chemical Association; Mr. Grover C. Broadnax, technical director, Pine Bluff plant, International Paper Company; and Mr. Robert Meyer, manager of Imperial Bag and Paper Company, Pine Bluff Arsenal.

GEN. TOFTOY TELLS CHESAPEAKERS MISSILE TECHNOLOGY NEW TO U.S.

Major General H. N. Toftoy, Commanding General, Aberdeen Proving Ground, Maryland, was guest speaker for the Chesapeake Chapter of the Armed Forces Chemical Association dinner-meeting held at the officers' open mess at the post on March 12.

General Toftoy, who has been one of the foremost exponents of the Army's rocket and guided missile program since World War II, was instrumental in bringing to this country a number of Germany's rocket scientists and engineers.

Speaking on "The Army Missile Program," General Toftoy stated in part: "At the beginning of the Army missile program in 1944, it was realized that we would be pioneering in a field entirely new to U.S. technology. Little was known about supersonic aerodynamics, the sound barrier, or thermal barriers when we started—there were no reference books on these subjects—no courses in our educational institutions."

In regard to Aberdeen Proving Ground's contribution to the missile program, he stated, "I feel without this country's first Supersonic Wind Tunnel and the ENIAC, the first high speed computer, both products of our Ballastic Research Laboratories here, we could not have established and maintained the successful Army Ordnance guided missile program. In fact, Aberdeen had the only supersonic wind tunnel in the country and for several years served private industry, the Navy and the Air Force, as well as the Army. The ENIAC revolutionized mathematical computation and spawned a new and important industry."

General Toftoy explained briefly the functions and capabilities of the various Army missiles.

Prior to the dinner-meeting, the A.F.C.A. group toured various parts of APG, beginning with a demonstration at the Supersonic Wind Tunnel and on to the Coating and Chemical Laboratory.

The Olin-Mathieson Corporation served as hosts to a cocktail party for the guests preceding the dinner-meeting.

GALA EVENING ARRANGED BY MIDWEST CH. FOR APRIL 23

A address by Major General Marshall Stubbs, the Chief Chemical Officer of the Army, on the subject "The Chemical Corps and Its Forward Planning," was scheduled by Midwest Chapter of A.F.C.A. for its Spring dinner meeting.

The dinner and program were planned to be held at the Officers' Club, Fifth Army Headquarters, Chicago, Illinois, on April 23.

PRESIDENT RUMFORD OF MIDWEST ON COMPANY DUTY IN ARGENTINA

Mr. Gaillard Rumford, president of the Midwest Chapter, left Chicago in February for a tour of duty at the Abbott Laboratories plant in Argentina. Mr. Rumford is one of two engineers who will endeavor to get the Argentine plant into operation as soon as possible. He expected to be away for approximately three months.

WILMINGTON CH. MEETING DEFERRED TO APRIL 14

The meeting of the Wilmington Chapter announced in the March-April issue of THE JOURNAL as scheduled for March 31, with an address by the Chief Chemical Officer of the Army, Major General Marshall Stubbs, was postponed to April 14.

General Stubbs' speech is published in this issue.

McCLELLAN HEARS TALK ON THE IRRADIATION OF FOOD

FORT McCLELLAN, ALA.—Dr. Robert E. Burks, Chief of the Organic Chemistry Section of Southern Research Institute, Birmingham, was the principal speaker at the March 20 meeting of the Fort McClellan, Alabama, Chapter of the Armed Forces Chemical Association.

Dr. Burks, who specializes in the research of food and flavors, discussed the possibilities of "Radiation Preservation of Food." He noted that by sealing food in an airtight plastic container and then radiating the container, it will be possible to kill bacteria that would ordinarily destroy the food. The effect of the radiation would create little or no change in certain types of food if administered in the proper quantities. The food would be safe for eating, and some types of food would be preserved up to two years. Dr. Burks said this process may be ready for use within the next three years.

Dr. Burks' discussion was one of a series of scientific talks of interest to both military and civilian members being presented by Fort McClellan Chapter of A.F.C.A.

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MR. WANSKER RECEIVES AN ARMY CITATION AT CHAPTER LUNCHEON

Mr. Harry A. Wansker, a vice-president of A.F.C.A., who recently retired as Director of Government Relations of the United-Carr Fastener Corporation, Cambridge, Mass., was presented a Department of the Army Citation at a "surprise party" luncheon in his honor at the Parker House, Boston, on January 15. New England Chapter of A.F.C.A. was host for the thirty-eight members and guests attending and the award was presented

by Brig. Gen. William E. R. Sullivan, Deputy Chief Chemical Officer of the Army.

FLOW OF IDEAS EXPECTED FROM "BLUE SKY PROGRAM"

Major General Marshall Stubbs, the Army's Chief Chemical Officer, speaking to a group of chemists in Boston, on April 7, urged them to apply their imaginations and furnish the Chemical Corps new ideas for the further development and improvement of the nation's defenses against chemical and biological attack.

General Stubbs spoke to the Committee of the American Chemical Society Advisory to the Chemical Corps during the annual meeting of the American Chemical Society, which was held in Boston this year. He stated, in part, as follows:

". . . We in the Chemical Corps are actively pursuing a program which, I am confident, will give us a constant input of ideas and concepts, both from within the Corps and from scientists and engineers of industry, universities and research organizations. Known as the 'Blue Sky Program,' it is designed to stimulate imaginative thinking on CW and BW.

"We need new and novel ideas that are applicable to our field of interest. . . ."

PROPULSION CHEMISTRY BRANCH FOR NAVAL RESEARCH OFFICE

To further research in the important area of propulsion, the Office of Naval Research announces establishment of the Propulsion Chemistry Branch. Research in solid and liquid propellants, the chemistry of combustion and other related phenomena will be included.

Dr. Ralph Roberts, formerly Research Coordinator, Chemistry, heads the new branch. Assisting him are two former members of the Power Branch, Mr. Richard L. Hanson and Mr. Bernard Hornstein.

COLLEGES AND UNIVERSITIES ENROLLED IN R.O.T.C. AWARD PROGRAM OF A.F.C.A.

Agricultural & Mechanical College of Texas, College Station, Texas
Bucknell University*, Lewisburg, Pennsylvania
University of California, Los Angeles 24, California
California Institute of Technology, Pasadena, California
Carnegie Institute of Technology, Schenley Park, Pittsburgh 13, Pennsylvania
University of Cincinnati, Cincinnati 2, Ohio
University of Colorado, Boulder, Colorado
Columbia University, New York 27, New York
Cornell University, Ithaca, New York
University of Delaware, Newark, Delaware
University of Detroit, Detroit 21, Michigan
Georgia Institute of Technology, Atlanta, Georgia
Idaho State College, Pocatello, Idaho
University of Illinois, Urbana, Illinois
Iowa State College, Ames, Iowa
State University of Iowa*, Iowa City, Iowa
Knox College,* Galesburg, Illinois
Marquette University,* Milwaukee 3, Wisconsin
Massachusetts Institute of Technology, Cambridge 39, Massachusetts
Michigan College of Mining and Technology,* Houghton, Michigan
Michigan State University,* East Lansing, Michigan
University of Michigan*, Ann Arbor, Michigan
Western Michigan University*, Kalamazoo, Michigan
Mississippi State College, State College, Mississippi
Missouri School of Mines & Metallurgy*, Rolla, Missouri
University of Missouri*, Columbia, Missouri
The University of Nebraska, Lincoln, Nebraska
North Carolina State College, Raleigh, North Carolina
North Dakota Agricultural College*, Fargo, North Dakota
University of North Dakota*, Grand Forks, North Dakota
University of Notre Dame*, Notre Dame, Indiana
Ohio State University, Columbus 10, Ohio
Ohio University, Athens, Ohio
University of Oklahoma, Norman, Oklahoma
Purdue University, Lafayette, Indiana
Rensselaer Polytechnic Institute, Troy, New York
The Rice Institute, Houston, Texas
Rose Polytechnic Institute*, Terre Haute, Indiana
Saint John's University*, Collegeville, Minnesota
Saint Peter's College, Jersey City 6, New Jersey
South Dakota School of Mines and Technology*, Rapid City, South Dakota
South Dakota State College*, Brookings, South Dakota
Vanderbilt University, Nashville 5, Tennessee
Wake Forest College, Winston-Salem, North Carolina
The University of Wisconsin, Madison 6, Wisconsin
Brigham Young University,* Provo, Utah
De Paul University *, Chicago 14, Illinois

* New additions to list for 1959 Awards.

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R. O. T. C. CADET AWARD PROGRAM OF A. F. C. A. NEARLY DOUBLED WITH 19 NEW ENROLLMENTS

(Participation of Association's chapters in Award ceremonies emphasized by the Award Committee—Further replies received in Committee's Follow-up survey of Award winners.)

THIS year marks a major increase in the R.O.T.C. Cadet Award program of the Armed Forces Chemical Association. Nineteen (19) additional colleges and universities recently added to the previous list bring the number of such institutions enrolled in this major A.F.C.A. activity to 47.

The Awards Committee, headed by Mr. Oliver F. Johnson of Washington, D.C., a former vice-president of the Association, is again stressing this year the participation by A.F.C.A. chapters in the award presentation ceremonies, which usually are conducted during the commencement period. The practice of having a representative of the chapter go to an institution where an A.F.C.A. award is to be made, and to make the presentation personally to the winning cadet has added materially to the recognition of the program both generally and by the institutions involved.

For the information of all concerned a complete list of universities and colleges now enrolled in the Association's program with indication of those recently added is published herein (page 4).

The program serves a dual purpose; it gives emphasis to the Association's recognition of the importance of the R.O.T.C. to the National Defense and, also, it helps to promote the scientific manpower resources of the nation. It consists in the award of a military type medal and scroll to outstanding students enrolled in the R.O.T.C.—Army, Navy, or Air Force—at selected colleges and universities. The recipient each year is selected on the basis of academic and military course standing of students in either Junior or Senior classes of the institutions concerned, who are majoring in chemistry, chemical engineering, or one of the allied sciences. Participation in worthy extracurricular activities is also considered.

While it is to be expected that outstanding young men, such as the A.F.C.A. award winners obviously are, will tend to do well in their subsequent professional or business careers, nevertheless, the Committee felt that a follow-up as to the current status and progress of these award winners would be of interest generally to our members, contribute to the value of the program, and possibly also be of benefit to the award winners themselves. Accordingly, a survey was inaugurated by Mr. Johnson, involving considerable correspondence, with a view to obtaining such information from these former students. A number of interesting letters resulting from this inquiry were published in the last issue of THE JOURNAL. In this issue excerpts from additional replies to this inquiry are published.

As might be expected—the award program having been carried on now for 10 years—in a number of cases the addresses of former students are not up-to-date in college files. Moreover, since a great many of the winners, especially during the last few years, have entered the military service, many of these have had a number of changes of station, and, in consequence, may have failed to receive the Committee's questionnaire. In some cases the colleges have undertaken to forward the Committee's inquiry by separate letter, while in others the names and addresses of award winners, as shown in the college files, have been furnished the Committee for writing direct to the award recipients. Thus it may be some time before all replies which the inquiry will eventually develop will reach A.F.C.A. Headquarters.

Following are excerpts from letters from R.O.T.C. award winners in addition to those quoted in the last issue of THE JOURNAL:

THOMAS O. DOBBINS

Air Force—West Virginia University, Morgantown, W.Va. Award Winner in 1955

". . . I was graduated from West Virginia University on 4 June 1956 with the degree of Bachelor of Science in Chemical Engineering. Immediately after my graduation, I accepted a chemical engineering position with the Research and Development Laboratories of Socony-Mobil Oil Company at Paulsboro, New Jersey. My stay at Socony-Mobil was a relatively brief one, as I reported for active duty with the Air Force on 19 October 1956. However, my 4½ months at Socony-Mobil were devoted to process development engineering studies in support of the Thermofor Catalytic Cracking process, which is the heart of the company's refining operation. My duties included the supervision of an experimental pilot plant catalyst circulation unit and the establishment of an air pollution study . . .

"On 19 October, I began a three-year tour of duty with the Air Force at Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. My initial 15 months at WADC were spent as a project engineer for the development of new lubricants for both turbojet and reciprocating aircraft engines. . . .

"Since January 1958, I have been a project engineer for the development of new, high-energy solid rocket propellants. This has proven to be a most interesting and challenging task in a rapidly-expanding area. My duties extend from pursuring basic thermo-dynamic investigations to the evaluation of new experimental propellant formulations. . . . In addition to these projects, I have been a member of the Air Force propellant team assisting the Advanced Research Project Agency of the Department of Defense. . . .

"While at Wright Air Development Center, I have also been working toward my Master's Degree in Chemical Engineering . . . through the Ohio State University extension program. . . . I anticipate receiving the Master's Degree in the Summer of 1959.

". . . I am, indeed, proud to be a recipient of this award, particularly in view of the keen competition among members of the R.O.T.C. and the small number of presentations made annually. . . ."

(Mr. Dobbin's present address is 160 Squirrel Road, Dayton 5, Ohio.)

JOHN C. HALE

Air Force—Vanderbilt University, Nashville, Tenn. Award Winner in 1958

". . . After graduation I was employed in my home town of Chattanooga, Tennessee, at the E. I. duPont nylon

plant, a job that I have held previously in the summer. This fall I returned to Vanderbilt to work on a Master's degree under an AEC Special Fellowship in Nuclear Science and Engineering. I would like to be able to continue my education through a Ph.D., if possible, and of course I still have my tour of active duty to serve. . . .

"I would like to add that I certainly deem it a high honor to be given this award. I can truthfully say that I consider the earlier holders of this award at Vanderbilt to be among the very top in the entire school, and I consider it a distinct privilege to be mentioned with that group. . . ."

(Mr. Hale's mailing address is—Box 498, Station B, Vanderbilt University, Nashville, Tennessee.)

JAMES ALLISON WILSON

Navy—Cornell University, Ithaca, New York. Award Winner in 1955

". . . After being commissioned in June, 1955, I entered Naval Flight Training at Pensacola, Florida. I completed training and was designated a Naval Aviator at NAS Corpus Christi, Texas on September 28, 1956, and was assigned to VF-73 at NAS Quonset Point, Rhode Island. After completing training with VF-73 in the spring of 1957 I, along with the squadron, was assigned to the USS Randolph, CVA-15, and was aboard during the period 1 June 1957 to 1 March 1958.

". . . On our return from the Mediterranean, . . . I was assigned at NAS Oceana, Virginia, where I served as Flight Officer until my release in September 1958.

". . . I am employed as a Chemical Engineer with the duPont Company at Circlesville, Ohio, in the technical section of their Mylar polyester plant. . . . I am a member of a Naval Reserve squadron based at Columbus, Ohio."

RONALD DARBY

Navy—Rice Institute, Houston, Texas. Award Winner in 1955

". . . After graduating with distinction from Rice in June of 1955 with a B.S. in Chemical Engineering, I immediately received my commission as Ensign, USN, and proceeded to report aboard the destroyer Theodore E. Chandler (DD 717) in San Diego for duty. I served aboard the Chandler for two years, during which time she made two six-months cruises to the western Pacific area. Some of the places visited for training, recreation, or duty included several ports in Japan, Formosa, Okinawa, Hongkong, Subic Bay, Philippines, Guam, Kwajalein, and Brisbane, Australia. My duties aboard the Chandler included Communications Officer, Electronics Material Officer, Navigator, Custodian, and Officer of the Deck. In June of 1957, I was transferred to the pre-commissioning detail for the radar picket vessel Newell (DER 322). . . .

"Upon my discharge from the Navy in June of 1958, I returned to Houston, where I am presently doing graduate work (at Rice Institute) with hopes of attaining my Ph.D. in Chemical Engineering. . . ."

DON E. CHILDRESS

Army—University of Illinois, Urbana, Illinois. Award Winner in 1955

". . . I received the A.F.C.A.-R.O.T.C. award at the University of Illinois in 1955. I completed the require-

(Continued on page 36)

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CBR—A POWER FOR PEACE

A more general recognition of the importance of chemical and biological warfare, its possibilities also in combination with nuclear means, and a call for creative thinking with suggestions to the Chemical Corps are among important points emphasized in the following address before the Wilmington Chapter of A.F.C.A., Wilmington, Delaware, on 14 April, by—

MAJOR GENERAL MARSHALL STUBBS
Chief Chemical Officer, U.S. Army

IN our justifiable concern with the increasing missile and nuclear threat that this nation faces, I am deeply disturbed that we have been and are neglecting an equal risk in the possibility of the use by an enemy of chemical and biological warfare. The danger to this country from such an attack, while of the same order of magnitude as nuclear, generally has not been so recognized or appreciated. We have not taken full cognizance of the advantage to a potential enemy of the combined use of nuclear and chemical and biological weapons. We recognize the threat of intercontinental ballistic missiles armed with nuclear warheads. Those same missiles that can deliver nuclear weapons can in turn deliver on target chemical and biological agents.

The world today accepts atomic power as a weapon for the deterrence of war. Prior to World War II the American people or the world knew little or nothing about its capabilities or effects. The bomb that fell on Hiroshima fell on America too. It fell on no city, reduced no man to his atomic elements, but it fell and shook the land. Its repercussion jarred our nation into the realization of the destructive might of atomic warfare. May we not have to have a C and B Hiroshima on one of our own cities to shake us out of our apathy to chemical and biological warfare!

Since toxic chemical warfare has not been used since World War I, this generation is not so well informed on its capabilities and consequently is apathetic as to its combat effectiveness. Coupled with this is the widespread belief left over from the first World War that its use is cruel and unethical. People fear what they do not understand. We can render a great service to our country by removing the cloak of doubt and suspicion surrounding the use of chemical and biological agents in war. We as a nation must realize that a potential enemy would not hesitate for a moment to employ these weapons if it would be to his advantage.

In his first annual address to Congress Washington said, "To be prepared for war is one of the most effectual means of preserving peace," a quotation that he had translated from Horace. That quotation holds as true today, but I should like to go one step farther and add that not only must we be prepared for war, but we must know the state of preparedness of a possible enemy. For in that knowledge we can know how to best assemble our forces and utilize our strength.

OUR greatest threat of another war, be it limited or general, lies in the rapidly growing threat of Communist aggression. A total of 18 examples of the use of force have arisen since 1945 varying in degree from guerrilla operations in Greece and Malaya to the North Korean aggression. There is no evidence that these will not continue to occur, and that the rate of occurrence may not increase. The Soviet Union has clearly demonstrated an increased belligerence in each succeeding crisis as in the recent Lebanon situation and the Taiwan Straits incident. The Soviet pressure on Berlin is the most recent example of that increased pressure. Since the Communists are well aware that both they and the Free World have atomic capabilities, it is reasonable to assume that they will be prepared to use all weapons in any future war, including chemical and biological munitions.

We have good reason to believe that Russia's heavy concentration on increased military capability includes the field of chemical and biological warfare.

In May of last year NATO published a memorandum warning the Western foreign ministers that the Soviet Union was ready for instant atomic warfare, backed by fully-tested missiles and was growing militarily stronger daily. It went on further to state that the Soviet rulers "may be tempted" to use their expanding war machine if they feel that they are losing the cold war. The possibility included germ warfare and gas. The newsletter said bluntly that the Soviet aim is "to establish throughout the world Communist regimes directed from Moscow."

PROGRESS 58, a recent Department of the Army report, devoted two pages to our assets and liabilities. It gives a balance sheet of Communist versus U.S. military strength. First item on the balance sheet is our 1958 Army of less than 900,000 men compared to 8,000,000 in the Sino-Soviet bloc. In this Communist bloc are 400 ground divisions compared to our 15. We have about 37 combat divisions in reserve while the Soviets alone could expand their present force to 300 divisions in 30 days and 500 divisions within a year.

Within these Soviet divisions is an organization devoted to the field of chemical warfare. Chemical troops are assigned to all echelons down to battalion. Statements by Soviet military leaders on the role of chemical and biological warfare in any future war are positive and are indicative of Soviet preparation to use, if they see fit, all weapons including toxic munitions.

SOVIET chemical weapons are modern and effective and probably include all types of chemical munitions known to the West, in addition to several dissemination devices peculiar to the Russians. Their ground forces are

equipped with a variety of protective chemical equipment and they are prepared to participate in large scale gas warfare. They have a complete line of protective clothing which will provide protection in any gas situation and a large variety of decontaminating equipment.

Much of their hardware is relatively simple in design and operations are often multipurpose. For example, flamethrowers may be used for the dissemination of either incendiary materials or persistent agents. Converted artillery shells, incendiary bombs, and rotational scattering aircraft bombs are used for chemical warfare purposes.

We can assume from available knowledge that they are equally capable in biological warfare. The mass of medical and technical reports published recently by their scientists indicates increased activity in this area. Soviet microbiologists and military authorities have conducted BW tests at an isolated location over a long period of time. It is also known that the Communists have conducted research and development leading to the large scale production and storage of disease producing and toxic agents.

Major General Yu. V. Drugov of the Military Medical Service, Red Army, stated on the 49th anniversary of the "Great October Revolution" that their scientists regard research on the action of poisons and on the developments of antidotes to be their patriotic duty. He attached special interest to the so-called psychic poisons (mescaline, methedrine, lysergic acid derivatives), insecticides (organophosphorus compounds) and poisons of animal origin.

Along with the stepped-up military and scientific program it appears that the deep interest of the Soviets can mean only one thing, that they have the capability of initiating chemical and biological warfare. I cannot believe that they would expend their critical resources to produce quantities of chemical agents for any other purpose.

An intensive program of mass education in civil defense against chemical and biological warfare has been in progress since World War II, and has received continued emphasis in recent years. A quasi-military organization called "DOSAAF" (Voluntary Society for Cooperation with the Army, Navy and Air Force) consisting of more than 30 million members, is the Soviet agency responsible for the widespread program. The organization extends to the smallest outlying village and insures adequate instruction in practical defense against chemical and biological agents.

While the picture I have painted you as to the preparedness of the Soviets in CBR is not a detailed one due to security limitations, I believe that I have given you enough to make you aware that they pose a threat to the free nations of the world. Coupled with that is the fact that their leaders have stated openly that future wars will be characterized by "various means of mass destruction, such as atomic, hydrogen, chemical and bacteriological weapons."

WE are, and rightly so, spending large sums to provide a defense against surprise attacks by land, air or sea, but at the same time we must guard against a covert CW-BW attack that could so readily happen. CW and BW weapons are equally suited for unconventional warfare. We must expect such type of operation in substantial amounts, because of the greater ability of the enemy to infiltrate our dispersed positions in atomic warfare, as well as the ease with which these materials may be used in subversive activities. Enemy agents could simultaneously deliver crippling blows to our critical installations, virtually neutralizing us to an open full scale massive attack. Let us consider for a moment the possibilities open to an enemy using biological agents. He can pre-select the results he desires to achieve. That is, he can choose from diseases ranging in effect from the mildly incapacitating, which would make one severely ill for several days, to prolonged incapacitation with few fatalities, up to those which result in high death rates.

Unlike some of the gases of World War I, germs can't be seen or tasted; they can't be felt and have no odor. The quantity required to produce results is exceedingly small, thus making it possible for effective attack of very large areas, with relatively small logistical effort.

Tests on a number of representative large size office buildings have shown that many of our installations are critically vulnerable. The effort required, the equipment involved, and the training necessary for effective BW attack are amazingly small.

One such test involved the use of a portable generator disguised in a brief case and placed near a ventilator in a building; another, a cloud of particles sent out from an apparently innocent looking vehicle on a road several hundred yards from a building. If actual disease producing organisms had been used in these tests by an enemy agent most of the people in the buildings would have been casualties.

The proven effectiveness of BW attack over large areas has also been confirmed by a number of field trials. Test attacks have been made both from ships lying offshore and from planes flying over the continental United States. These tests, in which a harmless tracer material was used, proved that coverage up to several thousand square miles could be achieved, with the population being wholly unaware that the attack had occurred. It should not require much imagination on your part for those of you who remember the influenza epidemics of World War I, and the recent incapacitating Asian Flu epidemic, both of which were spread by natural means, to visualize the potential dangers from a deliberate enemy attack in this manner.

THUS far, I have devoted the major portion of my talk to the potentials of our possible enemy. Time and security will not permit me to go into detail as to our own strength and readiness position. You have been told many times of our mission and developments, but I do want to mention one program that I feel sure will be of interest to you. We know that the Soviets are showing a marked interest in the incapacitating agents. In order for us to be prepared to defend ourselves against their use, we must know the effects they produce on people and countermeasures that can be taken. The Chemical Corps has been studying these psycho-chemicals for some time.

These agents have the ability to upset the behaviour pattern thus reducing a soldier's will to fight. Let me give you a few examples of how an enemy might employ these against us. A well-organized enemy inspired effort, by use of these agents among our troops, could disrupt and slow down normal thought processes and make radical changes in behaviour. For instance, combat-indoctrinated soldiers are trained to fight as a unit and obey orders in defense of a position. If subjected to one of these agents, they would lose the ability to work together and would probably think the entire situation hilariously funny.

An individual under the influence of one of these agents would become temporarily deranged and his reactions would probably be completely opposite from normal. In other words, an aggressive, outgoing person might want

to run and hide even from his fellow soldiers. Courageous people are apt to become timid, timid people become belligerent.

We know that the degree of incapacitation can be varied. Some of these can cause temporary blindness, or other physical or motor abnormalities, while still others could cause mental stupefaction or irrationality. We know that an aggressor would have a choice of delivery of these agents by aerial bombs, artillery, and other means.

I would like to touch on some problem areas at this point which I feel you and groups such as you need to be made aware of and suggest ways in which you can help us. First let's take a look at the thinking of the American people and, as a matter of fact, the entire free world. I want to discuss two phases of thinking—"inaccurate thinking" and "creative thinking."

We must do all we can to set the minds of our people straight as to the possible use by an enemy of chemical and biological warfare. The hazy and incorrect attitudes toward the use of these weapons are a hang-over from World War I. This generation has accepted them and passed them on much as Old Wives Tales have been handed down from one generation to another. I believe that these fallacies can be corrected. Certainly the public must realize that other nations have a strong CBR capability and that we must be prepared to defend ourselves with any weapon they might choose to use. Surely an enemy would be unwise were he to rely on one weapons system alone or to ignore any chink that we might have in our armor.

THE public must understand that a potential enemy would consider chemical and biological agents ideal for offensive use. They are ideal in that first, they are search weapons. They will seek out and reduce troops over a widely dispersed area, going deep into emplacements that standard munitions would not reach. Second, they are capable of achieving their mission without the destruction of property. An invader would want left intact the industries, buildings and equipment for his own occupational use. And last, chemical and biological weapons could be used to soften up an enemy prior to an all-out nuclear attack. Our nation must be awakened to this threat. People must be taught how to quickly identify a CBR attack and how to protect themselves.

Recently within the Corps, we have accelerated our information program. I am determined that our nation shall be told all that we can, within the limits of security. I have asked our personnel to contribute stories and articles about their work that would be of general interest. I am encouraging them to speak to groups about the Chemical Corps. There is much that we are doing through our research and development program that is contributing to the health, safety and well being of our nation. These are things people should know along with our military accomplishments. Each of you here has wide personal contacts among your friends and associates. Informed groups such as this can do much to contribute to a more realistic public attitude about CBR.

As to "creative thinking," I believe that we have within our Corps a team of military and civilian personnel who are outstanding in the amount and nature of the creative work they perform. However, we still need help from outside. As I mentioned earlier, scientists in Russia consider it their patriotic duty to do research that will benefit the military strength. While we certainly cannot advocate that in this country all research should be slanted toward the military, we do need the benefit of the most creative thinking by our scientists and engineers that can be applied to defense problems.

The present and probable increase in scientific advances of an aggressor country demands that we have the benefit of a constant flow of new ideas and concepts if we expect to keep ahead of them. Ideas that today may seem "out of this world" might be an actuality tomorrow. Space ships and guided missiles that a few years ago were seemingly only a figment of the imagination of the cartoon comic artist, today are becoming a reality.

WE have had in the past, and still have, an active industrial liaison program with approximately 450 industries participating. Through them we receive ideas, and compounds for screening for possible use by us. Often civilian laboratories have discovered some formula or process that while it is of no value to them, it may have great military possibilities. Because of budget limitations, our working staff in this program is small. I feel that the number of participating industries can be increased. Perhaps you can help us. You are in daily contact with people whose ideas and concepts we want. No matter how far fetched an idea or concept may seem we would like to know about them. The panel that we have appointed to screen these ideas does so with an open mind and all interests are fully protected. Your help can be invaluable to us in our search for more creative thinking in the area of chemical and biological warfare.

Let me give you an example of one of the ideas for which we are looking. Some of you may have run across a formula or a process that might help us arrive at a solution to this problem. We, in conjunction with the Quartermaster Corps and the Signal Corps are interested in designing an integrated combat suit that the soldier would wear constantly. We would like it to have the following qualities; it must be light in weight, and easy to wear. It must have its own built-in communications system; it must be flame and flash proof and must include some body armor, and most important to the Chemical Corps, it must be impervious to chemicals. Wars of tomorrow will require protection of this sort for our soldiers. You may think that my description sounds like a space suit of a man from Mars, and perhaps it does. I realize that it is a large order and I know that we won't accomplish this immediately. It is a project that I would like to ask you to give thought to, for I feel sure that with the help of people like you we can arrive at a solution to our problem much sooner. I will welcome your ideas.

To sum up, I have expressed my concern that national opinion has not recognized the threat that we face the possibility of a chemical and biological attack by an enemy. I have told you that the Soviets are not neglecting CBR warfare in their own military structure and that they have the capability to use it. I have cited examples of ways an aggressor might use chemical and biological warfare against us either covertly or openly. I hope that I have made you realize that we, as a nation, must overcome any impression that we can respond with a big bomb and little else. I have asked your help in creating a more informed public attitude toward the use of CBR and in stimulating creative thinking that will benefit our defense posture. For, to preserve the peace we must be prepared for war. In the words of General Taylor, "we must make crystal clear to both friend and foe alike that we can respond promptly with proper weapons and proper forces to any challenge."

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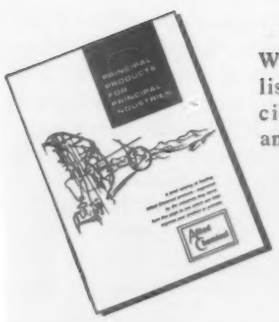

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BASIC TO AMERICA'S PROGRESS

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ADVANCED RESEARCH PROJECTS AGENCY

Back of the physicist and the engineer in, seemingly, every phase of today's space race, is that man with the test tube—the chemist. Here his essential tie-in with the space and missile program is expressed in the phrase "Chemicals not yet on the shelf." The following address on the need for and functions of the overall space agency in the Department of Defense was presented before the National Security Association of the American Legion, Washington, D.C., 31 January 1959 by the Deputy Director of the agency—

REAR ADMIRAL JOHN E. CLARK

United States Navy

John Edward Clark, Rear Admiral United States Navy, the Deputy Director of the Defense Department's overall space agency ARPA, is a native of Kansas. He was commissioned Ensign on graduation from the Naval Academy in 1927; remained there for additional aviation instruction and has held many important positions, particularly in connection with naval air operations.

I AM happy to be here with you today to discuss something of our national defense space research effort. There are reasons for confidence, as well as causes for concern. The challenge to all in the space research effort is immense. One of the hallmarks of our time is the extent to which political and social phenomena have come to be symbolized by, or expressed in terms of, economic and technological progress. Military preparedness has become a question of developing sophisticated, yet reliable weapons systems at an acceptable cost. It has become a matter of coping with the amazing speed at which events and discoveries transpire. This is particularly true in the area of space research. The issues we are facing apply directly to the vastly accelerated rate of change. To provide an operational agency for the management and conduct of advanced research projects, including those in space, the Advanced Research Projects Agency was established in the Department of Defense in February of 1958 for the purpose of performing research and development and space programs which are assigned by the Secretary of Defense.

In the Advanced Research Projects Agency, we are seeking to plan and direct activities which will prove vital to our national security and our exploration of space. ARPA now has many projects under way. Several of these are in the general field of ballistic missile defense. Our problems in this field can perhaps best be ascribed to the fact that we are in a situation of transition. I suspect that this transition antedates our first rocket firings toward space objectives. It probably began 15 or more years ago with the advent of nuclear power, useful for propulsion for energy or for destruction. We are now in a situation militarily where for the first time we can look forward to a carrier equal in performance to the weapon it transports, to an ICBM threat of formidable variety.

Now, we all recognize certain elementary features of this threat. First, of course, the ICBM and, therefore, its warhead, take but minutes between launch pad and target, so the defense will need a very fast reaction time. Second, the warhead will contain considerable destructive power in a small package and, therefore, may be very hard for the defense to locate accurately. Also decoys may accompany the warhead, making the prob-

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lem of discrimination quite difficult. Third, since the warhead must be very tough to survive re-entry, it may also be very hard to destroy.

Need For Co-ordinated Research

WITH full respect for these elements, in order to insure our adequate defense in the future, we need to know more about re-entry physics, that is, how different kinds of re-entering bodies behave, so that we can identify which re-entering body is the actual warhead and destroy it. We also need to know more about how a re-entry body looks to radar, to the eye, to infrared, and to other warning devices. In view of present radar limitations with respect to jamming and discrimination, we need to know how to use tools other than radar for early warning and tracking. One such possible tool is infrared. Additionally, we shall have to learn much more about the upper atmosphere, and particularly about the lethal effects there of nuclear weapons upon incoming warheads.

It becomes quite clear that a coordinated research program is needed. In ARPA we have therefore been constructing a national research program in physics, in radar techniques, in kill mechanisms, and in other systems, across the board, as needed for ballistic missile defense work. This is our first step and it is an absolutely essential one.

At this particular moment we cannot say positively what phenomena associated with long range ballistic missile firing is most interesting from a defense standpoint. Accordingly, we want to look at the missile during the launch phase, during mid-course and during re-entry with a variety of radar, infrared, optical devices and ordinary radio type receivers. ARPA has, therefore, begun a down-range instrumentation program at Cape Canaveral to try to determine the greatest vulnerability of intercontinental ballistic missiles.

Naturally, the program for ballistic missile defense which we are pursuing and will pursue, costs a good deal of money. However, when you consider that this research has a cost which is really quite small in relation to construction and operational costs of a conventional ballistic missile defense system, you realize that, through research, we can come up with efficient and economical solutions to the problems of the future. What I am saying is that it is better to spend a relatively small but sufficient amount of money determining which systems are poor, fair, good, and excellent, before choosing and developing a system which may in fact fall into a poor or fair category and nevertheless be exceedingly expensive. This would obviously give us little for our money.

A Challenge To Chemists

ANOTHER field in which ARPA is vitally interested is that of propulsion. As you know, we have authorized four major research contracts in the field of solid propellant research. The overall objective of these contracts is to greatly increase the specific impulse of solid propellants through development of chemicals not now on the shelf. The reliability, safety, efficiency and simplicity of solid propellant propulsion systems make them our real hope for future propulsion in missile and space programs.

In view of the overriding necessity for the United States Government to have an early capability to put very large payloads in space, ARPA has undertaken two important programs, one for development of a high energy upper stage, the other for a very high thrust booster. As you gentlemen know, for the next couple of years the United States' military and civilian programs will be largely based on the use of THOR, JUPITER, ATLAS and TITAN boosters. Whereas the THOR or JUPITER boosters, which have about 150,000 pounds of thrust, can launch upwards of 2,000 pounds of useful payload into low satellite orbits, the ATLAS or TITAN boosters can launch upwards of 4,000 pounds. To further our capability for putting greater weight in space utilizing an ATLAS type vehicle as first stage, ARPA has authorized the contract for development of a high energy, liquid fuel upper stage to achieve useful satellite payloads weighing up to four or five tons.

It has also ordered the clustering of existing ICBM type engines to provide a booster of 1½ million pounds of thrust. It becomes quite obvious that a booster of such capability, with appropriate upper stages, might place a manned space station into orbit or could launch a manned vehicle to circumnavigate the moon and return. Naturally the benefits of such programs are still two or more years off, but I assure you they are a part of an orderly, expedited program.

With regard to future military uses of space for the defense of the United States and the Free World, ARPA has initiated programs in the fields of communication satellites, navigation satellites, cloud cover satellites and satellies for early warning. ARPA is now also well along with a defense program to develop a recoverable space vehicle system.

These are the primary military applications, in addition to man-in-space, which are of special interest today because they can bring real benefits to our defense posture. By making use of our new found capability for orbiting objects in space, we can alleviate, if not solve, a number of military problems.

Aid To Military Communications

ONE of the most interesting of these concerns the use of satellites as communications relay stations, as has been demonstrated by Project SCORE, under which an ATLAS launch vehicle was used to place a highly successful communications payload into orbit. Since, through sufficiently high flying satellites containing radio relay equipment, broadcasts can be made from a single point to half the earth, we can obviously help the military with all of its communications problems—for logistics, for military control of equipment, men and aircraft—not just during a war but also during peacetime.

At the present time necessary economy dictates the maintenance of a small, highly flexible, rapidly mobile military force, with an accompanying requirement for management to maintain rapid world-wide communications with these forces. Only through such communication links is it possible to move military units expeditiously, for example, from Germany to Lebanon in support of national policy.

The Armed Forces of the United States today utilize substantially more than 50 per cent of the communications facilities available to the United States Government. The very existence of this requirement reflects itself in great shortages of frequency for civilian use. Should private industry or governments decide upon a world wide television network, for example, there will simply be insufficient audible frequency for the system.

One of our programs is, therefore, simply to utilize space as a means of withdrawing the Defense Department from civilian "air space." Through the use of a satellite based system, it is entirely possible to free "air space" frequencies now employed by the Department of

Defense, while insuring a very adequate communication system for defense purposes.

A somewhat similar situation exists with regard to navigation. Because vast areas of the world are inadequately plotted, a more accurate, space-based navigation system would be helpful to our world wide military movements and operations of many types.

In using satellites for navigation, we are really taking advantage of the satellites' similarity to the stars, which for a long time have been important to navigation systems. The important navigational difference, however, as you know, is that a satellite can be fitted out with a radio source which can be heard and detected from any ship, airplane or other object on the surface of the earth, at any time of day or night and in good or bad weather.

For Improved Weather Forecasting

MOST of you gentlemen are students of the history of warfare, and therefore you are quite conversant with the fact that military operations have always been dependent upon the weather. It is, therefore, of vital importance to the United States defense posture that the Department of Defense have the very best weather picture of areas in which it may be required to conduct operations in support of national decisions. I think you can well imagine that by getting out above the earth's weather a few hundred or thousand miles and looking back at the earth, entire cloud patterns can be seen and, therefore, an excellent idea may be gained of what the weather wil be in particular areas. Furthermore, by the aid of weather satellites, we can look back at the earth from above and see weather patterns over all parts of the world and not just over our own part. Just as ARPA is managing programs for communications and navigation satellites, so is it conducting a program for the development of a weather satellite system.

The matter of an early warning satellite is tied back into the need of this Nation to be adequately prepared should an aggressor country launch a sudden push-button attack against the United States. Such early warning satellites could also be useful eventually, under the auspices of the United Nations, for an international inspection system to insure that space is used for peaceful purposes.

In the field of recoverable satellites, ARPA has a long-term program under way known as Project DISCOVERER. This program may eventually be tied into our efforts to achieve manned space flight. For the present it is primarily involved with how we can recover satellites so that we do not have to waste extremely costly equipment, and so that we can achieve return of data which cannot be recovered by communications from satellite to earth.

Furthermore, in conjunction with our national man-in-space program, ARPA is vitally interested in development of maneuverable space vehicles.

I am sure I don't have to explain to your group that the defense of the United States has a vital requirement for space flight. I am particularly impressed by a recent report of the House Select Committee on Astronautics and Space Exploration which states that "it would be highly impractical not to face the reality that space technology, like nuclear energy, can be used for war as well as for peace. The United States must continue to strive for conditions which will make it possible for all space research to benefit mankind. But this effort is meaningless unless such striving is accompanied by an American and Free World effort to develop space devices of the highest order of versatility. Failure to do so would deny the Free World not only the peaceful benefits of space, but also the capability to detect hostile moves against these nations and the further ability to counter such threats."

We in ARPA feel that this attitude is really a primary foundation for the existence of our agency. I assure you that we shall continue to try to look into the future for development of breakthrough defense technology at a reasonable cost to the American people.

LEONARD MIKULES, NEW MANAGING EDITOR OF U.S. NAVAL INSTITUTE

Mr. Leonard Mikules has been appointed managing editor of the U. S. Naval Institute, succeeding Commander Roy Horn, who recently retired.

Mr. Mikules came to the Institute in 1954 after completing his Ph.D. at the University of California, Los Angeles. A Harvard 1930 graduate, he taught in Cambridge for several years before going into public relations and editorial work.

A commander in the Naval Reserve, he holds a Bronze Star for combat duty in the Pacific amphibious forces during World War II.

SOVIET CIVIL DEFENSE AGAINST CBR ATTACK*

THE wholehearted support the U.S.S.R. demands of its people extends to civil defense, including defense against CBR attack. While we in America content ourselves with infrequent passive air raid and evacuation drills, the Soviet Union has many millions of its citizens of both sexes organized into well-trained groups who can, at a moment's notice, come to the defense of every city, town, village, hamlet—indeed, every individual dwelling. The vast Soviet civil defense system embraces the entire country. And while we disbanded our volunteer air raid warning system immediately after World War II, the Soviet Union's civil defense system has grown and kept active in the postwar period.

Nor have the Soviets relaxed their vigilance against possible CBR attacks. Although World War II did not bring such attacks, Soviet authorities are still convinced that CBR weapons will be used in future wars. Alleged bacteriological warfare in Korea inspired a number of Russian books, articles, and pamphlets on the subject. For propaganda purposes and perhaps to justify their own preparedness for CBR warfare, the Soviets have continued to fabricate accounts that the free world has resorted to chemical warfare in other areas.

Active civil defense of the U.S.S.R. against CBR attack by enemy aircraft is provided by the Active Defense Group, *Protivovozdushnaya Oborona* (PVO). Under the control of PVO, a network of aircraft warning posts stretches across the Soviet Union. These posts, from which watchers scan the skies day and night, are known as Air Observation and Warning Stations *Vozdushnoe Nabludenie Opoveshchenie i Svyaz* (VNOS). Fighter planes and antiaircraft guns stand ready to go into action. In any attack, some enemy aircraft will undoubtedly break through to attack populated centers. At this time the Soviet passive civil defense system goes into action.

Passive civil defense is under the nationwide Local Air Defense Group, *Mestnaya Protivovozdushnaya Oborona* (MPVO). All "national-economic installations" *(obyekty narodnogo khozyaystva)* have MPVO groups. These groups are organized into teams of specialists trained to handle warning and communications, fire defense, first aid, CBR defense, shelters and covers, order and security, blackout, and—in farming areas—veterinary services. Small institutions, schools, apartment houses, and groups of dwellings, have MPVO "self-defense groups" who perform the same functions as the MPVO units in the larger installations. Special groups of Local Air Defense Squads (Komandy) are equipped with dosimeters and inspect damaged areas after attack to determine the degree of CBR contamination and to mark off contaminated areas.

MPVO draws support from many other organizations, including the All-Union Voluntary Society for Cooperation with Army, Air Force, and Navy, *Dobrovol' noe Obshchestvo Sovietskoy Armii, Aviatsii, Flotu* (DOSAAF), a society of over thirty million members from all walks of life and the principal means by which MPVO carries on passive civil defense training. With Stalin as its prime mover, DOSAAF was created in 1951. Its director is Army Colonel General Pavel Belov.

The fourth DOSAAF convention, February 1958, resolved that the most important task of the Society was to train the whole population for defense against atomic, biological, and chemical attack. Responsibility for this training was assigned to the Antichemical Defense Group, *Protivovozdushnaya i Protivo Khimitcheskaya Oborona* (PVKhO), in each of the primary DOSAAF organizations. PVKhO groups are instructed and trained by reserve and retired chemical service officers and by engineers, chemists, teachers, and medical personnel selected by DOSAAF.

COLONEL GENERAL BELOV
Heads society of 30 million members

DOSAAF strives to make all civilians from 16 years of age eligible to wear the "Ready for PVKhO" badge. To be awarded this badge, a Soviet citizen must complete a program in which he receives 20 hours of CBR classroom instruction and engages in outdoor training in CBR decontamination, constructing slit trenches, administering first aid, and extinguishing incendiaries and fires caused by them. To pass the examination he must have some knowledge of the kinds and effects of CBR weapons and of the methods of protection against them. He must learn to use the protective mask and protective clothing, be acquainted with antichemical equipment in the shelter, be able to utilize available equipment for traversing contaminated areas, and have some knowledge of hermetic sealing of water and food. He must know the rules to be observed when MPVO warning signals are given and the way the population is to conduct itself in a contaminated area. He is even taught veterinary treatment of animals.

In one exercise, PVKhO trainees responded to a night "chemical alert" alarm and went on a twenty-kilometer march during which they wore protective masks for three kilometers. In order not to interfere with the working hours of the group, this particular exercise began Sunday at 2 a.m. and ended at 9 a.m. Another PVKhO exercise involved a 35-kilometer ski

* Prepared by U.S. Army Chemical Corps Intelligence Agency

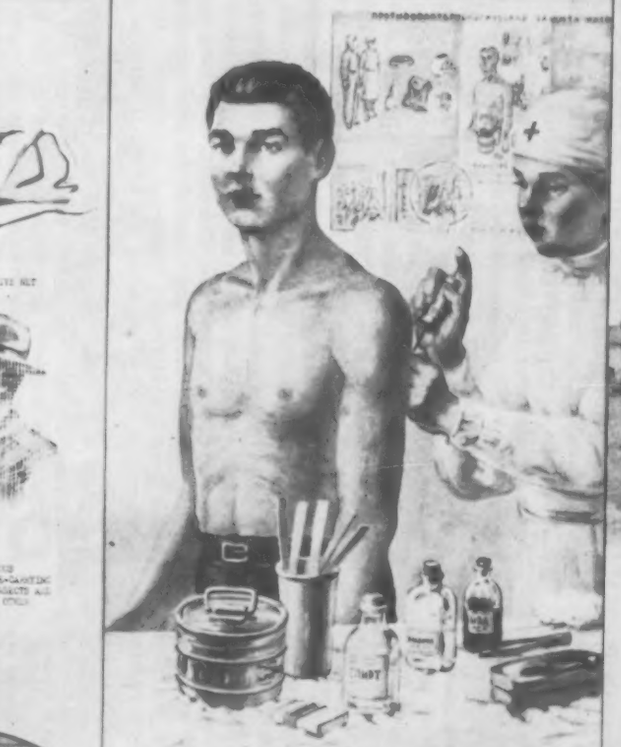
ANTIBACTERIOLOGICAL DEFENSE OF THE POPULATION

EQUIPMENT AND MEANS FOR INDIVIDUAL DEFENSE

MASKS OF INDIVIDUAL DEFENSE PROTECT RESPIRATORY TRACTS, MUCOUS MEMBRANES OF THE EYES, AND THE SKIN FROM INFECTION SPREAD BY DISEASE-CARRYING MICROBES AND TOXINS; THEY ALSO AFFORD PROTECTION AGAINST BITES BY INSECTS AND TICKS WHO ARE CARRIERS OF PEST, TYPHUS, ENCEPHALITIS, TULAREMIA AND OTHER INFECTIOUS DISEASES.

A SPECIALLY EQUIPPED, HERMETICALLY SEALED SHELTER OFFERS EFFECTIVE PROTECTION AGAINST INFECTION BY DISEASE-CARRYING MICROBES AND TOXINS.

IN A SHELTER NOT EQUIPPED AGAINST CHEMICAL PENETRATION AND ALSO IN CONTAMINATED AREAS, PEOPLE SHOULD WEAR GAS MASKS OR PROTECTIVE CLOTHES AND TAKE CARE.



PREVENTIVE INOCULATIONS INCREASE PEOPLE'S RESISTANCE TO INFECTIOUS DISEASES

DISINFECTION INCLUDES THE DESTRUCTION OF DISEASE-CARRYING MICROBES AND TOXINS IN CLOTHING, ON PAVEMENT, IN AIR AREA, AND ON OTHER OBJECTS.

DISINFECTION OF STREETS IS CARRIED OUT BY SPECIAL MACHINES SPRAYING DISINFECTING SOLUTIONS OR BY THE USE OF DRY CHLORINATED LIME FOLLOWED BY A WATER SPRAY.

SANITARY TREATMENT--ONE OF THE MEASURES TO LIQUIDATE THE EFFECTS OF BACTERIOLOGICAL ATTACK.

CIVILIANS, WOMEN, CHILDREN AND WORKERS IN ARMED AREAS MAY PROTECT THEIR FACES AGAINST CONTAMINATION BY DISEASE-CARRYING INSECTS AND TOXINS.

Strict Observance Of All Measures For Antibacteriological Defense Will Protect The Health And Life Of Many People

run in the dead of winter with protective masks worn for five continuous kilometers.

PVKhO groups are taught to expect chemical attack by airplane spray, chemical bombs, and artillery shells. They are told that bacteriological attack may be indicated by an aerosol spread by low-flying aircraft and that BW agents may be disseminated by rockets, bombs, and shells and by aircraft dropping boxes or packets containing infected rodents or insects. They are schooled in the measures against enemy overt or covert use of BW agents.

PVKhO instructors use textbooks such as the *Training Manual For Local Air Defense (Uchebnoy posobiye po MPVO)*, a 200-page, profusely illustrated work by V. D. Moskolev, V. P. Sinitsyn, and A. S. Tertychnyy, MPVO members. Published by the DOSAAF Publishing House, Moscow, 1956, the work describes the following: (1) characteristics and effects of lewisite, hydrocyanic acid, tabun, cyanogen chloride, phosgene, diphosgene, chloracetophenone, and adamsite, (2) methods of disseminating chemical agents, (3) physical principles of atomic weapons, the destructive "factors" of an atomic explosion, and combat radioactive substances, and (4) bacteriological agents and the diseases caused by them. Obviously seeking to create the impression that the U.S.S.R. is innocent of all BW activity—if not knowledge of the subject—the manual declares that its information on BW is derived from "foreign published data." The manual also deals with CBR decontamination, with "measures to eliminate the aftereffects of bacteriological attack," and with protection of the skin, foodstuffs, forage, and water against chemical agents.

Most Soviet books on the subject of civil defense are printed for mass consumption and are issued in the millions. The PVKhO groups also use pamphlets illustrating every aspect of defense against CBR warfare. A typical instructional pamphlet—the "Action of MPVO Self Defense Groups"—published by the DOSAAF Publishing House, 1958, has over 100 individual colored illustrations accompanying information on equipment to be used and defensive measures to be followed in civil defense against CBR attack.

Nor do the Soviets permit those trained in civil defense to forget what they have learned. Aware that civil defense training, particularly against CBR, is forgotten in time, DOSAAF conducts refresher courses every two years. Citizens who have acquired "Ready for PVKhO" badges must pass examinations regularly to retain their badges.

A Soviet Civil Defense Badge

Little information is available on shelters in the U.S.S.R. Chemical defense shelters were used in World War II. Since the end of hostilities apartment and office buildings have been erected over reinforced basements that furnish protection against chemical and atomic attack. The Soviets are certainly aware of the value of shelters and may be actively providing for them. A civil defense manual implies that shelters are available. It declares that—

> A simultaneous protection of a large number of people from the effects of a shock wave of demolition and atomic bombs, light radiation, penetrating radiation, and toxic substances is ensured by collective means of protection—shelters and other protective installations of MPVO. (V. P. Sinitsyn *et al., Local Civil Defense (Mestnaya Protivovozdushnaya Oborona,* Moscow, 1956, p. 54.)

The DOSAAF biweekly *Soviet Patriot (Sovetskii Patriot)* on 18 March 1957 announced a new film, Civil Defense Against Atomic Warfare *(Protivoatomnaia Zashchita Naseleniia)*, which presented shelters in homes and subway stations, methods of constructing sheltered passages, dugouts, and galleries, and other "collective and individual means of defense against atomic attack."

"Services" under the chief of a rayon (local urban or rural area) or city MPVO group include a Shelter and Cover Service that provides the population with necessary shelters and covers and controls shelter construction. The *Training Manual for Local Air Defense* assures its readers that "among the most reliable means of defense against atomic weapons are properly equipped and prepared MPVO shelters and covers." (p. 32)

In statements made for public consumption, the Soviets have tried to minimize the dangers of atomic warfare. A typical statement is that of two Russian writers in 1956:

> Preparing themselves for a new world [these writers declare] the imperialists are trying to frighten the world with atomic and hydrogen weapons. The reactionary press, exploiting the common man's ignorance of the true properties of atomic weapons, fabricates numerous fairy tales, especially about radioactivity. But, while the howlings of these scribblers may intimidate persons with weak nerves, they cannot intimidate the Soviet people. The Soviet Armed Forces, which have the most up-to-date combat materiel and atomic and hydrogen weapons, are vigilantly guarding the borders and are prepared to smash any aggressor disrupting the peaceful life of the people. (Syrnev, V.P. and N.P. Petrov, *Radioactivity and Its Measurement,* Moscow, 1956, p. 6).

Nevertheless, special attention is given to organizing the population for defense against atomic attack. DOSAAF has formed Atomic Protection Circles, *Kruzhki Protivoatomnoy Zashchity* (PAZ), of 20 to 25 members who receive training in atomic defense two hours weekly. The Union of the Red Cross and Red Crescent Societies, *Soyuz obshchestva Krasnogo Kresta i Krasnogo Polumesyatsa* (Sokk i KP) assists DOSAAF in training members of PAZ Circles to familiarize the population with atomic weapons, individual and collective defense against atomic attack, first aid for atomic attack casualties, and the action taken on sounding of MPVO signals. Members of the All-Union Society for the Promotion of Political and General Sciences organize lectures and scientific reports on atomic weapons and atomic defense to increase the skill and knowledge of PAZ members.

PAZ Circles, who also train the population in BW defense, give considerable attention to instructing the

Soviet people in self-decontamination after a nuclear attack. They are taught to carry out partial decontamination—that is, washing all exposed parts of the body—as soon as possible after leaving the stricken area. They are to receive complete decontamination at public bathing installations with the help of medical personnel and are then to be given a dosimetric test.

The Soviet population is also thoroughly organized for defense against CW attack. On warning of a toxic CW attack, all MPVO units in large installations and all self-defense groups carry out MPVO measures in their immediate areas to include emergency decontamination by six-man decontamination squads pending arrival of PVKhO decontamination details. Medical squads trained by the Union of the Red Cross and Red Crescent Societies carry toxic agent casualties to decontamination stations.

DOSAAF instructors stress identification of CW agents. PVKhO personnel are trained to handle man-pack and truck-mounted decontamination equipment.

The Soviet people are instructed to have protective masks, capes, socks, and gloves in readiness for protection against CBR attack. Using visual aids displayed throughout the country from propaganda trucks *(Agitmashina)* DOSAAF instructors remind the population that these items of protective equipment are to be donned at the first warning of an attack. It may be questioned, however, whether the Soviet people are adequately supplied with protective equipment; for although protective masks are sold by DOSAAF stores everywhere in the U.S.S.R. the people may be reluctant to purchase them because of their cost—the equivalent of 14 dollars, or 10 percent of an average Russian's monthly income. It is also likely that, because of indifferences to civil defense, many Soviet citizens may not purchase available protective equipment. But such equipment is maintained in office buildings, factories, tractor stations, and key installations where primary MPVO units are organized.

(Continued on page 24)

RUSSIAN CIVIL DEFENSE POSTERS

The pictures on pages 17, 20, 21 and 22 are photographic reproductions of selections from poster-type drawings pertaining to the Civil Defense program of the U.S.S.R., originally printed in color. The posters are widely distributed in the U.S.S.R. and copies available for sale in certain stores. Slides of Russian Civil Defense posters shown by Dr. Paul A. Lindquist in connection with his paper at the American Medical Association meeting on Civil Defense in Chicago, November 8-9, 1958 (printed in this issue) were from this same group of photographic reproductions of the poster pictures.

The titles of the posters and explanatory captions of the various activities depicted in the posters have been translated into English and the typed English translations superimposed over the Russian printing before the black-and-white reproductions were made.

The poster sets, which are used for instruction purposes, cover the entire range of civil defense procedures, including shelters, fire-fighting, and blackout, as well as measures for dealing with nuclear, chemical and biological warfare attacks. English translations, or paraphrases of same (as indicated) of these posters here presented follow:

Page 17: ANTI-BACTERIOLOGICAL DEFENSE OF THE POPULATION

(Captions summarized)

Upper Left: Masks, Protective Clothing and other items of individual defense.
Upper Center: Preventive inoculations increase resistance to disease.
Upper Right: Showing inside and outside disinfection methods.
Lower Left: Inside Protective Shetlers, noting need for wearing masks or protective cotton where air purification is not provided for the enclosure.
Lower Right: Protective covering for food and cooking utensils, and use of showers to remove remains of BW attack.

Pages 20-21: BACTERIOLOGICAL WEAPONS

Left Margin: Bacteriological weapons are means of mass destruction. Their destructive action is carried out by disease-spreading microbes and toxins for deliberate attack on people, animals and plants.
Indications of use of Bacteriological Weapons:
A muffled explosion and the absence of BRV* and OV in the area of the explosion;**
The passage of an aircraft and subsequent appearance of smoke or mist above ground;
Presence of drops of liquid and traces of powder-like material on the ground and surrounding objects;
Discovery of a great quantity of insects, ticks, rodents and various objects unusual for the location;
Disease and murrain among animals.
Right Margin: The enemy may use bacteriological warfare weapons in various ways and at any time of day and year:
By dropping bombs loaded with infectious microbes and toxins, and various containers with infected insects, ticks and rodents from aircraft or balloons;
By spreading infected insects and ticks from an aircraft with the help of various devices;
By sabotage, the enemy may contaminate water, food supplies, fodder, and also spread infection in normally congested areas (Railway stations, Motion Picture theaters, etc).
(Inset Group of 5 Pictures)
Upper Left: (Microscopic pictures of 4 types of germs):
(Left to Right)—Typhus Rickettsiae; Pest Bacteria; Tularemia Bacteria; Vibrio of Cholera.
(Below)—Microbes are the smallest living organisms and may be seen only under a microscope.
Upper Right: To disseminate disease-carrying microbes and toxins, the enemy may use aviation bombs and long-range guided missiles. Special bombs, Containers, Packages and Sacks may be used for dissemminating infected insects ticks and rodents. The enemy may use ampules and portable spraying devices for spreading disease-carrying microbes, toxins, infecten insects and ticks, as a method of sabotage.
Lower Left: (Top Row—Left to Right)—Flea, Louse, Mosquito, Fly.
(Bottom Row—Left to Right)—Gopher, Rat, Mouse.
(Below)—Infected rodents are natural carriers and infected insects are transmitters of infectious disease.
Lower Middle: An individual stricken with an infectious disease excretes a large quantity of live microbes, and may become a source of contagion for healthy individuals.
Lower Right: Determining the type of disease—carrying microbes and confirming the correctness of diagnosis of an infectious illness in the medical service laboratories of the MPVO*.**
*** Boyevoye Razryvnoye Veshchestvo—Combat Explosive**
****Otravalyayushchiye Veshchestva—Poisonous Substances**
***** Mestnaya Protivovozdushnaya Oborona—Local Antiaircraft Defense.**

Page 22: RULES OF CONDUCT FOR PEOPLE IN A CONTAMINATED AREA (Captions summarized)

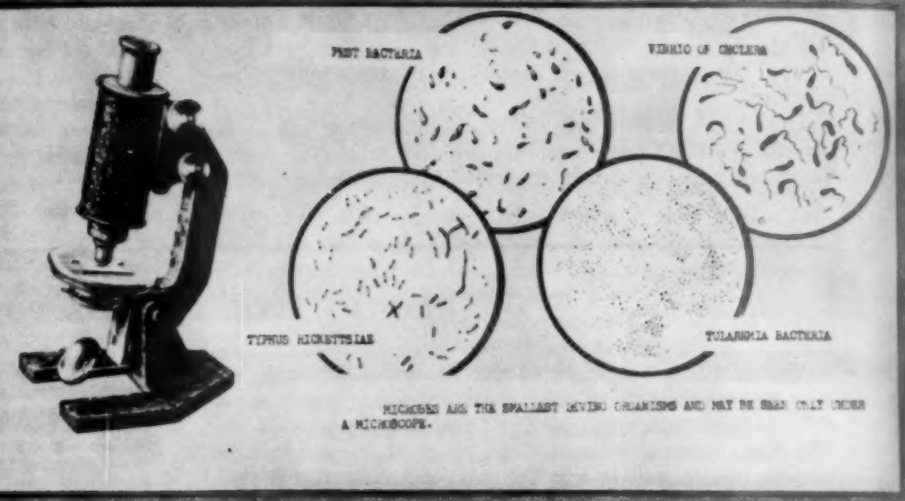
Caption at top states that when in a contaminated area, it is necessary to follow strictly rules of conduct and safey measures.
Upper Left: Statement that it is forbidden to leave the undamaged shelter until chief warden gives the appropriate order.
Upper Center: In case shelter is damaged and occupancy dangerous, on order of chief warden, people are to adjust available safety devices and leave in orderly manner.
Upper Right: Caution to observe marked routes in passing contaminated area.
Lower (4 pictures)—Warnings against removing masks prematurely; sitting or lying down in contaminated area; touching surrounding objects; and warning against smoking, eating or drinking when in a contaminated area.

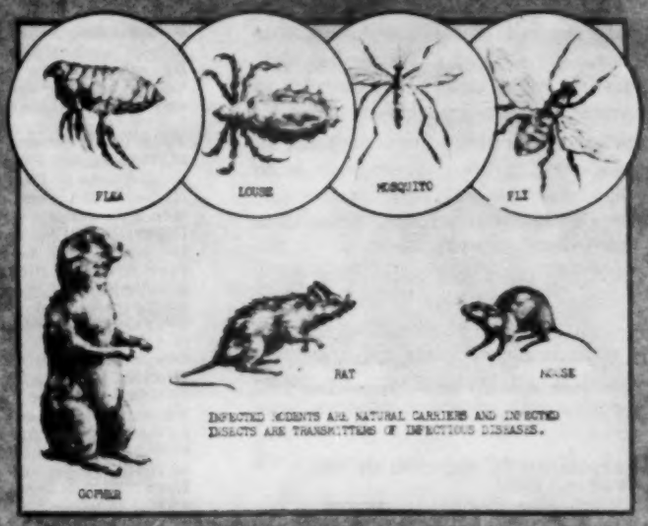
BACTERIOLOGICA

BACTERIOLOGICAL WEAPONS ARE A MEANS OF MASS DESTRUCTION. THEIR DESTRUCTIVE ACTION IS CARRIED OUT BY DISEASE-SPREADING MICROBES AND TOXINS FOR DELIBERATE ATTACK ON PEOPLE, ANIMALS AND PLANTS.

INDICATIONS OF USE OF A BACTERIOLOGICAL WEAPON:

- A MUFFLED EXPLOSION AND THE ABSENCE OF H2O AND CO2 IN THE AREA OF THE EXPLOSION;
- THE PASSAGE OF AN AIRCRAFT AND SUBSEQUENT APPEARANCE OF SMOKE OR MIST ABOVE GROUND;
- PRESENCE OF DROPS OF LIQUID AND TRACES OF POWDER-LIKE MATTER ON THE GROUND AND SURROUNDING OBJECTS;
- DISCOVERY OF A GREAT QUANTITY OF INSECTS, TICKS, REPTILES AND VARIOUS OBJECTS UNUSUAL FOR THE LOCATION;
- DISEASE AND PERSONS AMONG ANIMALS.


PEST BACTERIA
VIBRIO OF CHOLERA
TYPHUS RICKETTSIAE
TULAREMIA BACTERIA
MICROBES ARE THE SMALLEST LIVING ORGANISMS AND MAY BE SEEN ONLY UNDER A MICROSCOPE.



*ОБЩИЕ БАКТЕРИЙНЫЕ ЯДОХИМИКАТЫ - GENERAL BACTERIAL POISONS

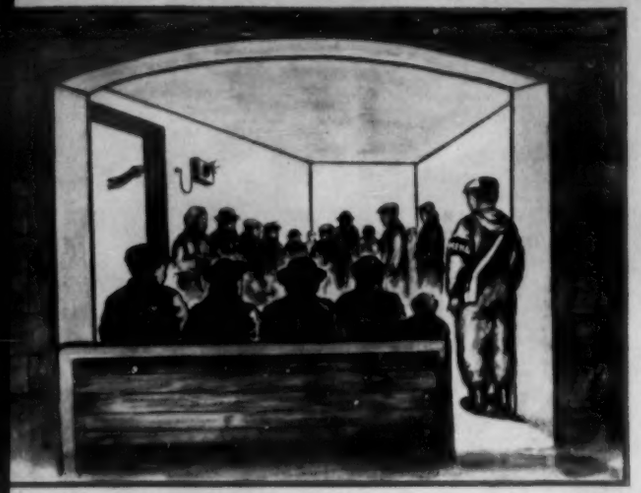
**ОТравляющие ВЕЩЕСТВА - POISONOUS SUBSTANCES

GICAL WEAPONS

TO DISSEMINATE DISEASE-CARRYING MICROBES AND TOXINS, THE ENEMY MAY USE AVIATION BOMBS AND LONG RANGE GUIDED MISSILES. SPECIAL BOMBS, CONTAINERS, PACKAGES AND SACKS MAY BE USED FOR DISSEMINATING INFECTED INSECTS, TICKS AND RODENTS. THE ENEMY MAY USE AMPOULES AND PORTABLE SPRAYING DEVICES FOR SPREADING DISEASE-CARRYING MICROBES, TOXINS, INFECTED INSECTS AND TICKS AS A METHOD OF SABOTAGE.
THE ENEMY MAY USE BACTERIOLOGICAL WARFARE WEAPON IN VARIOUS WAYS AND AT ANY TIME OF DAY AND YEAR:
- BY DROPPING BOMBS LOADED WITH INFECTIOUS MICROBES AND TOXINS AND VARIOUS CONTAINERS WITH INFECTED INSECTS, TICKS AND RODENTS FROM AIRCRAFT OR BALLOONS;
- BY SPREADING INFECTED INSECTS AND TICKS FROM AN AIRCRAFT WITH THE HELP OF VARIOUS DEVICES.
BY SABOTAGE, THE ENEMY MAY CONTAMINATE WATER, FOOD SUPPLIES, FODDER AND ALSO SPREAD INFECTION IN NORMALLY CONGESTED AREAS (RAILROAD STATIONS, MOTION PICTURE THEATERS, ETC.)
DETERMINING THE TYPE OF DISEASE-CARRYING MICROBE AND CONFIRMING THE CORRECTNESS OF DIAGNOSIS OF AN INFECTIOUS ILLNESS IN THE MEDICAL SERVICE LABORATORIES OF THE MPVO***
***MASTNAYA PROTIVOVOZDUSHNAYA OBORONA - LOCAL ANTIAIRCRAFT DEFENSE

RULES OF CONDUCT FOR THE POPULATION IN A CONTAMINATED AREA

IN A CONTAMINATED AREA, POISONOUS AND RADIOACTIVE SUBSTANCES, DISEASE-CARRYING MICROBES AND TOXINS IN THE AIR, ON THE GROUND, IN BUILDINGS, TRANSPORT VEHICLES, WATER AND UNPROTECTED FOOD, PRESENT A GREAT DANGER TO PEOPLE. THEREFORE, WHEN ONE IS IN A CONTAMINATED AREA IT IS NECESSARY TO FOLLOW STRICTLY THE ESTABLISHED RULES OF CONDUCT AND SAFETY MEASURES.



IT IS FORBIDDEN TO LEAVE THE OVERCROWDED SHELTER AFTER AN ENEMY ATTACK UNTIL THE APPROPRIATE ORDER IS RECEIVED FROM THE CHIEF WARDEN OF THE SHELTER.

IF THE SHELTER HAS BEEN DAMAGED AND FURTHER OCCUPANCY IS DANGEROUS, ONE MUST, ON ORDER OF THE CHIEF WARDEN, PUT ON THE AVAILABLE SAFETY DEVICES AND LEAVE THE SHELTER IN AN ORDERLY MANNER EITHER THROUGH THE MAIN OR AN EMERGENCY EXIT.

CONTAMINATED AREA MAY BE TRAVERSED ONLY BY FOLLOWING MARKED PASSAGES.

WHEN IN A CONTAMINATED AREA

FAILURE TO OBSERVE THESE RULES MAY LEAD TO DEFEAT

FAILURE TO OBSERVE THESE RULES MAY LEAD TO DEFEAT

CHEMICAL AND BIOLOGICAL WARFARE

PAUL A. LINDQUIST, M.D.
Acting Deputy Director, Health Services, Office of Civil Defense Mobilization
Battle Creek, Michigan

I WOULD LIKE to start with two definitions defining chemical warfare and biological warfare from a civil defense point of view. Chemical warfare is the intentional use of toxic chemicals to kill or confuse man. Biological warfare is the intentional use of living organisms or their toxic products to produce death, disability, or damage to man, animals, or crops. Note that both chemical and biological warfare are concerned only with living things. These two types of warfare have frequently been called unconventional warfare. They have nothing whatsoever to do with conventional weapons which cause physical destruction not only of humans but of equipment and facilities.

Nuclear and thermonuclear bombs are conventional weapons if we consider the blast and heat effects. Fall-out, however, is in a sense an unconventional weapon since it adversely affects only living things. Chemical and biological weapons or agents are far more flexible than fall-out and offer a wide spectrum of effects. In the case of chemical warfare agents, we have a whole series running from such tear gases as bromoacetophenon, through such lung irritants as phosgene and such vesicants as mustard, to the newer and highly lethal anticholinesterase agents commonly known as nerve gases.

In the field of biological warfare agents we may consider bacteria, viruses, rickettsias, protoza, and toxins. These in turn vary greatly in their infectivity and in the resulting mortality rate. For example, Rickettsia burneti (Coxiella burnetii), the organism which produces Q fever, has a high infectivity but one would not expect many fatalities. On the other hand, the yellow fever virus and Bacillus anthracis cause a high incidence of death. Between these extremes, there are many variations. Biological warfare agents may also be delivered by different means. Aerosols may be very effective, as well as vectors.

Background

The use of chlorine as a chemical warfare agent was proposed in the early days of the Civil War for use by Northern troops against entrenched Confederate troops. It was not then practical, since the production of chlorine was extremely limited. It was not until a large chemical industry had been built up that toxic chemicals could be used effectively in sufficient quantity in combat.

At the outbreak of World War I, Germany controlled the chemical industry. It is not surprising, therefore, that on April 21, 1915, the Germans released large quantities of chlorine against unprotected allied troops. It was a surprise attack launched early in the morning under favorable meteorological conditions. It resulted in 5,000 casualties and the complete demoralization of 15,000 troops.

In first using chemical warfare agents, Germany did not actually break the Hague Agreement of 1899, since this agreement specifically limited the signatories to abstain from using toxic chemicals "in projectiles." The Germans had used static cylinders. Later the same year, the Germans used phosgene. Both of these agents are lung irritants, and eventually protection was developed through simple gas masks. To overcome this protection, the central powers launched, in July, 1917, a mustard gas attack which circumvented the mask by penetrating through the skin. In the first three weeks, the Allies suffered 14,000 casualties and 500 deaths. It has been estimated that gas warfare alone during World War I caused 1,200,000 casualties, of which 400,000 were due to mustard.

During World War II the Germans developed another type of toxic chemical, which was neither a lung irritant nor a vesicant but an anticholinesterase agent which attacks the central nervous system. What these agents were was entirely unknown to the Allies until depots containing them were discovered by American, British, and Russian forces. These agents are today considered a possible serious threat to the United States.

Physiologically, these nerve gases inhibit the production of cholinesterase, thus permitting the unrestricted production of acetylcholine with subsequent uncontrolled muscular activity. The only acceptable therapy for nerve gas casualties is the rapid injection of atropine. In severe cases, atropine alone is ineffective and artificial respiration is essential. To illustrate the high toxicity of one of these nerve gases, I might point out that hydrogen cyanide would have to be inhaled at a concentration of 5,000 mg. per cubic meter for one minute to cause 50% casualties. On the other hand, a nerve gas would require 100 mg. per cubic meter for the same length of time to produce the same results.

Not too much is known about biological warfare agents in military operations; however, Dr. Fothergill, in MILITARY MEDICINE, July 1958, stated, "Infectious disease has often been a critical factor in the outcome of a military campaign." For example, bubonic plague is said to have stopped the Crusaders at the gates of Jerusalem; dysentery probably caused more casualties in Napoleon's Grand Army than enemy firearms; typhoid and the dysenteries played havoc in the Boer and Spanish American Wars; typhus prevented the Germans from carrying through their Balkan campaign in World War I; and in World War II scrub typhus caused 7,000 casualties in the southwest Pacific. In the Korean war, encephalitis B (Japanese type) and hemorrhagic fever were serious medical problems. Little can be said of the intentional use of pathogenic organisms or their toxic products; however, it may be noted that the Germans in World War I are said to have infected horses in the United States destined for the Rumanian Cavalry with glanders. In World War II, German occupation troops stationed in eastern Europe are believed to have been intentionally infected with pathogenic organisms. So much for the brief background on chemical and biological warfare.

Future Uses

What are the Russian interests in these two types of weapons? In January 1957, Defense Minister Zhukov stated before the Communist Party Congress: "The USRR is rebuilding its Armed Forces on the basic assumption that the means and forms of future war will

Extracted and reprinted by permission from a paper by Dr. Lindquist published in the January 24, 1959 number of *The Journal of the American Medical Association*. This paper was presented by him before the Ninth County Medical Societies Civil Defense Conference held in Chicago, Nov. 8-9, 1958, sponsored by the Council of National Defense and the American Medical Association.

differ in many respects from past wars. We will see the mass use of air power, various types of missiles, and means of mass destruction like nuclear, chemical and biological weapons."

There was an interesting article published in MILITARY MEDICINE and PHARMACEUTICAL REVIEW (Yugoslavia) by Col. Adam Milkovich in the November-December, 1956, issue. After discussing chemical and biological warfare, the colonel states, "There is less knowledge, less talk, less writing, less thinking about them, and therefore, there is less work done in preparation of defensive measures. The main reason, however, for this is not that biological weapons have never been used in war, but that the use of them has never been detected as was the case with atomic and chemical weapons." Later the colonel states, "From results of comparative studies of losses of life from conventional weapons, war poisons and atomic weapons, on the one hand, and losses from biological weapons on the other, it is believed today that a biological war would have the greatest effect of all." In closing, he states: "Present experience has shown that no special significance would be attached to international decisions on this matter and that it is practically impossible to control either the preparation or the use of biological weapons in wartime."

* * * *

[Dr. Lindquist followed his remarks above with a showing of slides of some Russian posters indicating interest in chemical and biological warfare.

In concluding his presentation, Dr. Lindquist showed some other slides pertaining to certain field tests by the U. S. Department of Defense in the study of biological warfare which had been used in an address by Dr. LeRoy D. Fothergill, of the Biological Warfare Laboratories of the Chemical Corps, Fort Detrick, Maryland. That address by Dr. Fothergill was made at a previous Civil Defense Conference conducted by American Medical Association. It was held in San Francisco on June 21, 1958.

The Fothergill slides had to do with area coverage and concentrations obtained in outdoor experiments involving release of simulated agents in aerosol form from a ship moving offshore and upwind of the target areas concerned. Dr. Lindquist remarked upon the extensive areas covered and the concentrations obtained in these tests, as shown by these slides, and quoted from Dr. Fothergill's address. Dr. Fothergill's speech alluded to here was printed in full, by permission of the American Medical Association, in the November-December 1958 issue of the Armed Forces Chemical Association Journal.—Ed.]

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SOVIET CIVIL DEFENSE

(Continued from page 19)

Soviet propagandists conduct an incessant campaign against the indifference of the population to civilian defense. This propaganda seeks to motivate zealous participation in civil defense activities by instilling fear or enthusiasm in the masses. Curiously inconsistent with the policy of minimizing the dangers of atomic warfare, it seeks to frighten the Russian people by reminding them that they are constantly threatened by the "capitalistic warmongers" who may at any time attack the U.S.S.R.—and with CBR weapons.

Active participation is also encouraged through a system of awards, badges, and citations. It must be remembered that to be socially acceptable a Soviet citizen must participate in as many community activities as possible. The extent of his participation will in part determine his opportunities for promotion on his job and will offer him other rewards— for example, scholarships. By badges indicating his community achievements and by "performance reports" posted by the chairman of the committee of a primary DOSAAF organization, which keeps careful records of its members, a citizen gives proof of loyal service to the community. Thus, a DOSAAF publication praises a certain "Comrade Zyamzin, a former soldier of the Soviet Army," for his organizing abilities in the Vulkaneshtskaya (Moldavskaya SSR) rayon DOSAAF organization, one of the first rayons "to complete the training of its population in defense against atomic attack." ("For the Motherland") [*Rodine*], Moscow, p. 148.)

In addition to the "Ready for PVKhO" badge, every DOSAAF member is expected to earn the "Ready for Work and Defense" badge which, worn by a student, housewife, teacher, artist, or scientist, is evidence that its wearer is ready to work for the defense of the U.S.S.R. Those who complete PAZ training receive a certificate and the title "volunteer DOSAAF Instructor for Defense Against Atomic Attack" *(Obshchestvenny Instruktor DOSAAF po Protivoatomnoy Zashchite)*. Instructors who complete the training of more than 250 PAZ circle trainees are awarded the highest DOSAAF decoration.

Civil defense must have mass participation to be effective. On this score, the U.S.S.R. is reasonably successful.

FT. McCLELLAN CHAPTER HEARS AIR ROTC EDUCATION ADVISOR

FORT McCLELLAN, ALA.—Dr. Merle F. Ogle, who is Educational Advisor at Maxwell (Ala.) Air Force Base's Air Force ROTC Headquarters, was the speaker at the February meeting of the Fort McClellan chapter of the Armed Forces Chemical Association.

Dr. Ogle discussed many of the current problems confronting American education, particularly the aspect of financing the education of one's children.

The speaker was introduced by Lt. Col. Keith Mahon, senior Air Force Representative at the U.S. Army Chemical Corps School.

Col. Carl V. Burke, U.S. Army Chemical Corps School Commandant, presided over the meeting.

5,000 RADIOLOGISTS ASKED TO AID CIVIL DEFENSE PROGRAM

Five thousand radiologists are being asked to contribute their services to aid the radiological defense program of the Office of Civil and Defense Mobilization.

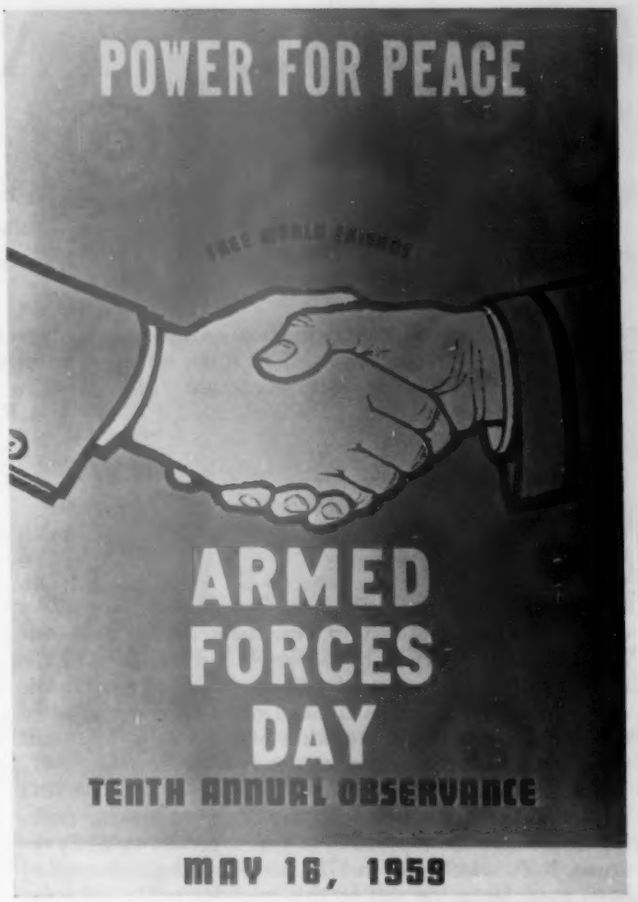
Because of their specialized education and experience, the radiologists, members of the American College of Radiology, are particularly well suited to assist OCDM in developing a national operational capability in radiological defense. Such a capability would assure rapid and accurate evaluation of the extent and intensity of fallout across the nation in the event of a nuclear attack, OCDM states.

The Chancellors of the American College of Radiology recently asked their members to assist in this civil defense project.

OCDM is now training and equipping radiological monitors and, OCDM points out, to complete this program assistance from organizations like the American College of Radiology is needed.

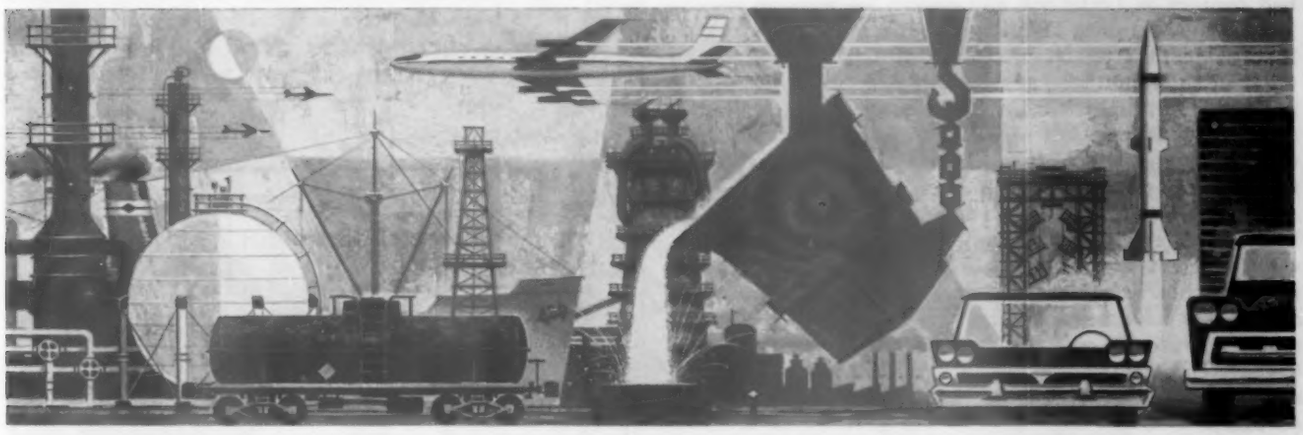
Director Leo A. Hoegh, of Civil and Defense Mobilization, recently announced a new series of radiological defense courses to train monitor instructors, radiological defense officers, civil defense directors and their other staff members.

Four Radiological Defense School courses of one week each will be given at OCDM's Operational Headquarters in Battle Creek, Michigan.



This is the 1959 Armed Forces Day poster which again this year emphasized "Power For Peace."

The Nation's Top **100** Industrial Corporations All Use Harshaw Chemicals



For each of 50 different industries, including the Nation's top 100 industrial corporations, Harshaw produces a variety of important chemicals. For instance, the Petroleum Industry regularly purchases catalysts, metallic soaps, salts and crystals. The Automobile Industry buys electroplating chemicals and anodes, catalysts, fluorides, pigments and metallic soaps. The Chemical Industry uses products from six of our ten industrial divisions.

Harshaw produces over 1000 different chemicals for more than 15,000 customers throughout the World. *Probably we have a chemical you can use.* If you have something specific in mind ask us. At your request we'll forward a catalog listing our major products and describing our company.

THE HARSHAW CHEMICAL CO.
1945 EAST 97th STREET • CLEVELAND 6, OHIO
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES
HASTINGS-ON-HUDSON • PHILADELPHIA • PITTSBURGH

HARSHAW

SALT

By

Col. Harry A. Kuhn, USA-Retired
Chemical Consultant
Washington, D.C.

(The growing economic importance of caverns in underground salt deposits for storage of liquids, and the possibility of their use for disposal of dangerous atomic waste are discussed in this article by a former president of A.F.C.A.)

SALT is one of the more abundant minerals of the earth and probably longest known to man. Salt is essential to all animal life and to a lesser extent to plant growth. Like a need for water, the need for salt has frequently decided the course of history. Wars have been fought over salt taxes. Civilizations have waxed and waned over the right to their access to salt. The ancient caravan trails of the Sahara and the Arabian Desert were established for traffic in salt. In many parts of the world today salt remains a government monopoly.

The first patent issued in America was granted in 1641 by the Massachusetts Bay Colony for a process for making salt. The manufacture of salt in the vicinity of Syracruse, N.Y., was begun in 1788, although the Indians had been manufacturing salt in this area for centuries prior to that time.

Deposits of salt are widely distributed in great beds from the Appalachian to the Rocky Mountains. Beds extending from New York to West Virginia and Michigan cover an area of about 70,000 square miles. Deposits in Kansas, Colorado and Texas occupy an area of about 100,000 square miles. The most extensive and deepest bed centers in Louisiana and covers an area of about 180,000 square miles. These salt beds range from several hundred feet to 6,000 feet in depth. Although we are moving over 20 million tons of salt each year from these vast deposits our supply will last for thousands of years. Industry uses 95 per cent of our salt production and it is one of the most widely used raw materials of the chemical industry.

The Chemical Corps has always been vitally interested in salt as a raw material for chlorine. Every chemical warfare agent developed in World War I and to date requires chlorine in its production and our wartime requirements have been so large as to require an immediate expansion of chlorine capacity in both world wars. Commercial chlorine plants are usually operating at capacity for essential civilian uses which could not be curtailed to divert chlorine to meet military need and additional government capacity was built at each chemical warfare agent manufacturing plant.

Following World War II the chlorine plants at Edgewood, Huntsville, Pine Bluff and Rocky Mountain Arsenals were continued in operation by commercial producers to meet expanding civilian needs. Following World War II another chlorine plant, the largest of the five, was built at the Muscle Shoals, Alabama, old agent plant. This plant, with a capacity of 225 tons/day of chlorine, is now being operated commercially to supply non-military needs.

During the past 60 years almost 500 million tons of salt have been removed from the earth. Today the holes left by the removal of that salt have become almost as valuable as the salt removed to make them. As underground storage vaults they may be as vital to life as the salt they contained.

Only a few decades ago liquid petroleum gases such as butane and propane were regarded as waste gases and consumed in the oil field flares. Today the use of liquid petroleum gases has expanded 7,000 times and has become the key to our way of life. Without them we could not operate our automobiles and airplanes, trucks and buses, our farm tractors and stationary engines. A large part of our population depend on them for heat and cooking. Today without these "waste" petroleum products our economy would grind to a halt.

However, the demand for liquid petroleum gases is seasonal and reaches a peak in the wintertime far in excess of production. This necessitates the storage of millions of barrels of liquid petroleum gases in the slack season to meet this peak demand. Within the past 10 years it has been found that worked-out salt mines and empty salt wells make ideal storage vaults. Petroleum products will not dissolve salt nor will they contaminate it and salt forms a very efficient seal. They cost less than 10% of above-ground storage and require very little maintenance.

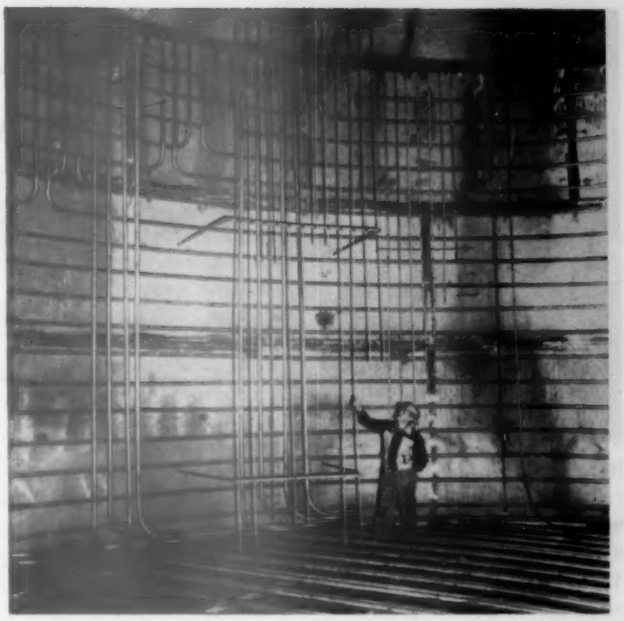
Colonel Kuhn was an undergraduate in chemical engineering at Carnegie Institute of Technology when he joined the Gas Warfare Investigation Laboratory of the Bureau of Mines in June, 1917. He was commissioned First Lieutenant in 1918 and retired for physical disability in 1946. He has been a chemical consultant since 1946 and Washington representative of Allied Chemical Corporation. He received the Distinguished Service and Army Commendation Medals in World War II.

Today salt caverns form a chain of reservoirs for liquid petroleum gases extending from Texas to Michigan. It is estimated that last year there were 36 million barrels stored in these salt caverns. The storage requirements rapidly exceeded the ready-made storage capacity in abandoned mines and wells and most of these salt caverns have been made to order. Currently a vast salt cavern with a capacity of over one million barrels made by dissolving salt with water in the methods shown in the sketch is under construction. Only a few years ago this single cavern would have been ample to store all of the liquid petroleum gases produced in a year.

The salt caverns in one sense are the key to our modern food supply. There is good reason to believe that they will be also the key to survival in the atomic age we are entering. Every atomic reaction produces large quantities of radioactive waste, some of which will remain reactive and dangerous to life for 1,000 years. To date no way has been found to dispose of these high level waste products other than to seal them in containers and store them indefinitely under supervision. In the few years that we have been in atomic operations we have accumulated about 70 million gallons of high level waste. In the foreseeable future this may reach a billion gallons which must be stored at a cost of possibly one dollar per gallon, a big factor in expanding atomic power.

Preliminary tests indicate no significant reaction between this high level waste and salt. Storing this high level waste in salt domes, salt beds and abandoned salt mines would reduce the cost of storage immediately—no storage tanks to be built and maintained indefinitely. Field tests now being undertaken by the Atomic Energy Commission in salt beds in Kansas may give the solution to a costly problem in atomic power development and assure safety from this highly toxic waste for centuries.

The Chemical Corps, which has the responsibility of disposing of radioactive material from Army programs, will no doubt be interested in this development. In addition to possibilities for atomic waste storage, the salt caverns might offer a solution for disposal of deteriorated chemical agents that would have advantages over dumping them in containers in the ocean.

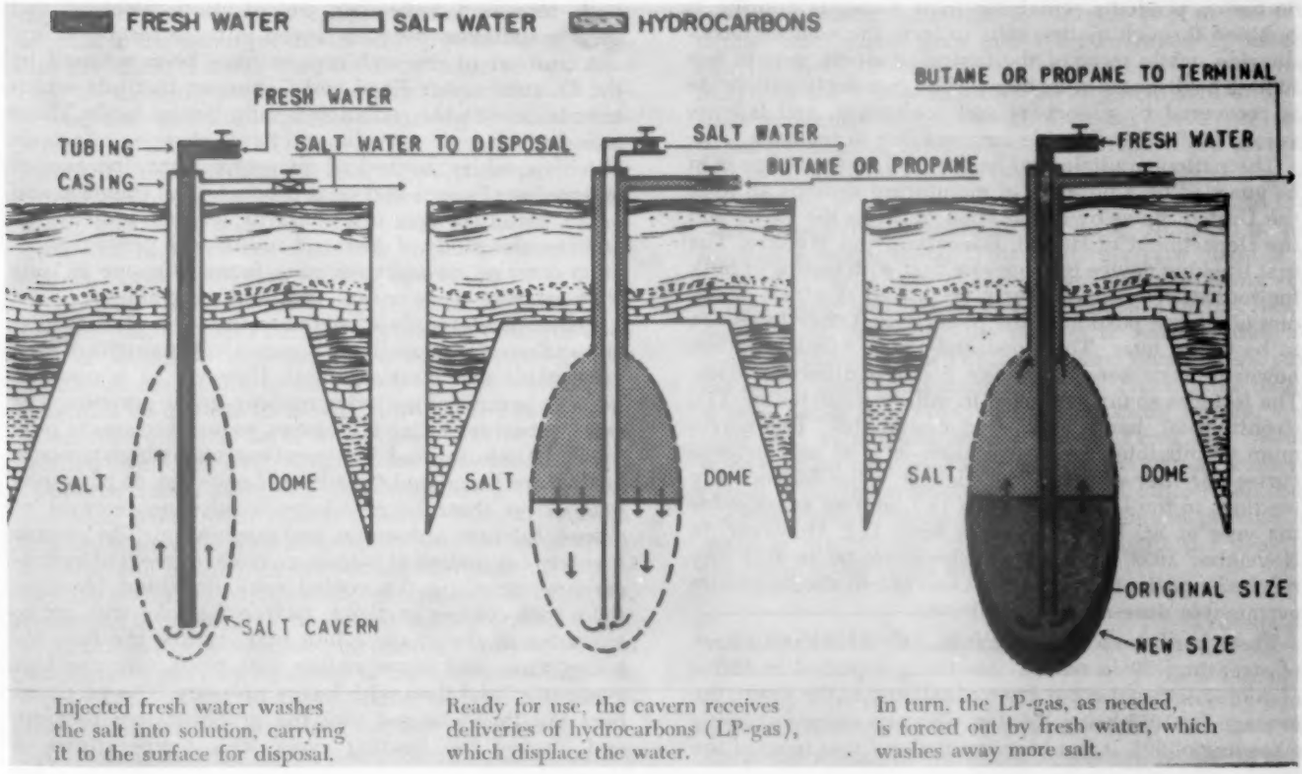


Stainless steel storage tank for high level waste—cooling coils remove heat of radioactivity. National Reactor Testing Station—Idaho. *(AEC 5626)*

The Joint Congressional Committee on Atomic Energy has recently conducted a two-weeks hearing on the problem of disposing of atomic waste which included discussion of storage in underground salt caverns.

A worked-out salt mine, or a salt well is more than a hole in the ground—it has a profitable future.

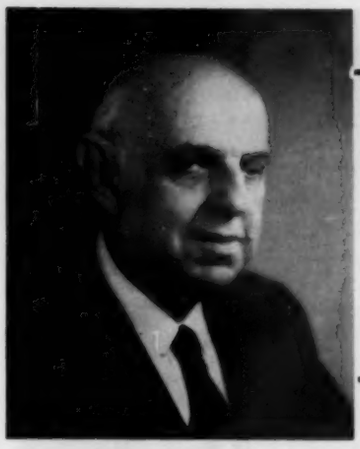
(This illustration is reprinted, by permission, from "Light Ends," an article by Paul V. Morris, in the January 1959 issue of "Service," published by the Cities Service Company for its employees and customers.)



Injected fresh water washes the salt into solution, carrying it to the surface for disposal.

Ready for use, the cavern receives deliveries of hydrocarbons (LP-gas), which displace the water.

In turn, the LP-gas, as needed, is forced out by fresh water, which washes away more salt.



DEFENSE CHEMISTRY IN THE NEWS

By WILLIAM T. READ, SR.

In order to describe more completely the purposes of this section, the title has been changed to DEFENSE CHEMISTRY IN THE NEWS. This means that condensations of releases from the Office of Technical Services and of articles appearing in the technical journals relating to Department of Defense activities in chemistry, chemical engineering, and kindred subjects, will be supplemented by material from such journals that is of probable militarly interest, but which is not directly related to any Defense Program. Unless specifically so stated in the text, the information presented is not to be construed as based upon original or official sources. W. T. R.

NUCLEAR CHEMISTRY

Uranium is now being recovered from reactor fuels in a process in which no water is used. The material fed to the recovery plant, now in the pilot plant stage, is made up largely of sodium and zirconium fluorides with around 2.5 mole per cent of uranium tetrafluoride, which is highly enriched and which contains fission products. The process depends on volatility and absorption techniques. Uranium is recovered as uranium hexafluoride which has no fission products remaining in it. Gaseous fluorine is bubbled through molten salts to form the volatile hexafluoride, while most of the fission products remain behind to be disposed of by burial. The gaseous hexafluoride is recovered by absorbers and cold traps, and is converted to the tetrafluoride for use again in reactors.

The nation's radiological health in the atomic age is to be guarded by a network of monitoring stations all over the United States by cooperation between the states and the Department of Health, Education, and Welfare. The first tracking device is to operate first with testing of milk for radioactivity, particularly because it is a part of the diet of a large portion of the population. Other foods are to be tested later. The Food and Drug Administration, however, tests something like a dozen different foods. The isotopes so far measured in milk include iodine-131, strontium-90, barium-140, and cesium-137. The maximum permissible dose of strontium-90 is 80 micromicrocuries per liter of milk. The highest value for monthly readings in the United States is 18.7. and an average for the year at St. Louis, Mo., has been 11.2. However, in November 1958 the value of strontium-90 in this city reached a peak of 20.1, or about one fourth the maximum permissible dose mentioned above.

There has been a decided increase in the concentration of strontium-90 in wheat, this being reported in terms of micromicrocuries per gram of calcium in the grain, the average for 1955 being 155, but with one sample showing a reading of 606. It has been pointed out that most of the calcium in wheat is discarded in the bran, and that consumers of whole wheat products get only a fraction of their calcium from grains. In soil the unit reported is microcuries per square mile, with figures covering the total content of strontium-90 in the soil and the amount added yearly by fallout. Considerable publicity is being given to recent estimates that the time that deadly radioactive materials remain in the stratosphere is nearer two to four years than seven, a value heretofore generally accepted. Experts, however, agree that the chances of an individual getting a deadly dose of strontium nitrate from material descending from the stratosphere is of the order of 1 in 500,000.

Since nuclear-propelled aircraft will require lubricants and hydraulic fluids resistant to radiation, the Air Force is carrying out studies on the effects of high-energy, high-intensity electromagnetic radiation on a variety of organic liquids. These include esters, hydrocarbons, and miscellaneous compounds. The radiolysis of organic liquids appears definitely to be influenced by structure, those molecules having branching chains and benzyl groupings being more susceptible to radiolysis than those made up of straight chains. Stability appears to increase with increased molecular weight. Both electron and gamma radiation were employed in these tests.

A number of research reports have been released by the Quartermaster Food and Container Institute which have to do with the radiation sterilization of foods. These include such topics as color and flavor changes, effects on nutritive values, control of microorganisms, increase of acceptance of meats and meat products, and chemical and organoleptic changes in carbohydrates and proteins. In an extensive study of chemical additives to prevent radiation damage, no additives were found effective in tests with representative meats, fish, and vegetables.

Freon, dichlorodifluoromethane, the versatile refrigerant and aerosol propellant, is commonly thought of as a very stable and inert chemical. However, it is now the key to a process of purifying nuclear-grade graphite. The chief impurities which it removes, as it dissociates to produce free chlorine and fluorine at extremely high temperatures, are boron and vanadium. Long periods of graphitization at these temperatures insure the removal of silicon, calcium, aluminum, and magnesium. The process involves calcination of petroleum coke to free it of hydrocarbons; grinding the cooled coke fines and blending them with coarser particles; mixing the coke with pitch; extrusion of the mixture into bars; baking the bars for a long time; and impregnation with pitch with previous evacuation and then with heavy pressure. The prepared bars are then charged into the graphitization furnace, and, during the heating cycle with temperatures of

5,000°F to 5,400°F, freon gas is forced into the furnace through pores in the bed. The gases are continuously vented and scrubbed as they escape, The finished bars are cooled, machined, and wrapped in boron-free paper.

METALS

Several devices that will simulate the corrosive effects of rocket exhaust on metal and paint-coated surfaces have been developed by the Air Force. Exposure in these devices has been shown to be uniform, and differences can be demonstrated between different surfaces. Specimens exposed to rocket exhausts during airflight can be qualitatively compared with other specimens tested in the laboratory devices. In one piece of equipment, a large number of specimens can be exposed to a single firing of a propellent charge. In another, small quantities of a propellant can be burned under very low-hazard conditions. Multiple samples of hot, high-velocity exhaust gases of an aircraft armament rocket can be employed against as many as 72 specimens with a high degree of uniformity.

Electron beam processing of metals is receiving considerable attention in the technical press, as several companies are announcing both melting and welding equipment for use with refractory and high-purity metals. These processes have in common the feature of operation with high vacuum. One machine has two separate chambers, one for electron emission and the other for melting, each at different but very low pressures. The beam is constricted at one point to pass through an opening small enough to keep the two vacuum systems separate. The electron gun is also protected from gases emanating from the molten metal. It has tantalum as a source, and operates at 20,000 volts potential. Metal powder or sponge is the usual feed, and the molten metal goes to a cold mold from which it is retracted as an ingot. A variable rate of operation permits the holding of a section of the metal containing impurities until the required purity is attained. Machines of this type are also adapted to vacuum deposition of refractory metals, and to alloying by high-vapor-pressure elements. Welding by the use of the electron beam method is particularly adapted to the joining of metals with high melting points, and the claim is made that welds so made are not discernible even by photomicrography. Impurities are removed and none are introduced. Brazing is also accomplished by the same equipment. The metals most commonly melted and formed into ingots from powder or chips include niobium, tantalum, zirconium, and molybdeum, and larger steel ingots are also produced. Beryllium and hafnium are included, in addition to these metals, in electron-beam welding operations.

Nitrogen trifluoride as a replacement for oxygen in brazing, welding, and cutting torches has been the subject of extensive experiments which indicate greater industrial use in the future. Ammonia and natural gas may also be used as fuels with nitrogen trifluoride. The temperature of the flame approaches that of hydrogen burned with fluorine. The combustion products are hydrogen fluoride and nitrogen. Pre-mixing of the new oxidizing agent with fuel is possible without ignition. Some metals form fluorides, which function as fluxes in welding and brazing. In the cutting of metals, after preheating with the hydrogen-nitrogen trifluoride torch, the hydrogen is cut off and the cutting action continues, and some alloys can be handled that are not cut by an oxygen stream. Oxygen may be added to the nitrogen trifluoride stream. The gas is relatively stable, may be handled in steel cylinders, and also does not corrode glass.

Cadmium may be vacuum-deposited on high-tensile steels to prevent corrosion, hydrogen embrittlement being avoided at the same time. Immediate application is in the field of aircraft, which require high-heat-treated steels, which are in danger of hydrogen embrittlement if electroplated in baths containing acids. In vacuum plating, no hydrogen can be present.

The problem of electronic component parts which operate at 500°C appears to have moved much nearer a solution by the development of the deposition of a combination of a ceramic and an inorganic binder on metal substrates. The resulting material is employed in the fabrication of capacitors and insulated wire. The research carried on for the Air Force involves a technique known as "slurry ceramics," materials of the slurry for wire coating including alumnia, monoaluminum phosphate, and additives. Coatings as thin as 0.001 inch were applied to 24-gauge nickel wire, and, before curing, the coated wire could be wound on a ½ inch mandrel. An aluminum foil of the same thickness as the coating just described was coated and formed into capacitors. The ceramic was sealed against dehydration and given abrasion protection by an overcoating of polyvinyl chloride-acetate copolymer.

The refractory metals, niobium, molybdenum, tantalum, and tungsten are being produced by power metallurgical methods in large ingots, which make possible the fabrication of aircraft-size sheets. Up until this year ingots made from these metal powders rarely went over 100 pounds. Now 500 pound ingots of molybdenum are being produced, together with a 350 pound bar of molybdenum-tungsten alloy, and ingots of niobium, tungsten, and tantalum. The technology involves forming the metal powder into bars with pressures reaching into thousands of tons, followed by sintering in a high-frequency induction furnace. Arc cast melting, by which much larger ingots are formed, is still extensively employed, although powder metallurgy is said to be a cheaper and simpler process. Arc-cast molybdenum, however, is said to have the advantages of better weldability and easier machining. The nation's missile and space programs are credited with the increased interest in the production of these refractory metals, although the largest part of molybdenum output still goes into the steel industry as an alloying metal. Another recently developed process for molybdenum, also applicable to tungsten, is a single-stage reduction of molybdenum oxide directly to the metal. Production rates are said to be increased several fold by this advance in making metal powders.

Rhenium, whose discovery dates well back within the memory of living chemists, is now being produced in the form of wrought metal. This relatively rare metal is a by-product originally of the copper industry, being removed along with much larger quantities of molybdenum. However, during the process of roasting molybdenum flue dusts, much of the rhenium escaped as a gas, the oxide, Re_2O_7, subliming at 450°C. The soluble oxide is now being recovered by a water-spray system, and converted to ammonium perrhenate. From this, metal is now being produced by hydrogen reduction. Present capacity for the wrought metal is still quite small, but the many special applications of this element promise to increase the present rate of 1,000 pounds per year to twenty to thirty times this figure.

ELECTRONIC MATERIALS

Transistor grade silicon is being prepared by a method developed by the Air Force by continuous decomposition of silane, which also involves the prepartion of silane and its fractionation. The process

is more rapid than the former use of silane batches. The total amount of silane present at any one time is much less, since decomposition occurs before high concentration of the starting substance can be attained. Production of 94% to 100% silane is carried out by reduction of silicon tetrachloride by hydrides. Other features of the investigation included the possible development of purifying agents, variables in silane decomposition, and the effect of the quartz deposition medium and a hydrofluoric leach on the purity of the product.

Two Air Force reports recently released to industry describe methods for the production of manganese bismuthide, MnBi, a material which has highly promising magnetic properties. The mercury process involves incorporation of manganese and bismuth into a mercury slurry. Vacuum distillation removes the mercury at a lower temperature than ordinary atmospheric distillation and avoids oxidation. This process produces powdered manganese bismuthide identical with methods now in use. The second method is characterized by low-temperature reactions, some 72 hours being required, but results in a product of high purity. Powders used in the process require careful protection against oxygen and moisture during the whole operation.

FUELS AND LUBRICANTS

Storage in bulk of petroleum fuels of the heavier type without use of ordinary structural materials such as steel and concrete is taking various forms in recent developments. One suggested method is to dig a reservoir out of the ground, line it with a synthetic, rubber-coated fabric, and cover the fuel with the same material, or with a blanket of foam made from a synthetic resin. Going a step further, the Army Engineer Corps has sponsored a study in which soil is paved and sealed with a gel made from petroleum fuel and clay or an oil-wettable powder. Such a reservoir is in use in Venezuela, being clay, lined with subsequent asphalt spraying. The Army Engineers operating in very cold climates merely dig a pit in the ice, line it and seal it with ice-slush, cover it with plywood and store aviation gasoline in such a reservoir without loss.

The usual objective of tests of protective coatings on steel is primarily to determine the extent to which the metal is enabled to resist the attack of container contents. A reverse of this procedure is carried out by Army Ordnance Corps in finding out the effects of fuel container materials and coatings on gasoline gum formation and the oxidation stability of the gasoline. It was found that current fuel tank liners, paint systems on interiors of bulk storage tanks, copper and brass fittings, and even clean steel surfaces have had considerable effect on the rate of gum formation. Exposure tests were for 500 hours at 150°F. Only six of all coatings tested gave the desired protection, these including the new baked-on paint system and five air-dry coating systems. The latter all contained butadiene-acrylonitrile copolymer and phenolic resins. The acceptable systems also gave increased oxidation stability.

Ferrocenes, all derivatives of the parent substance first given this name and described as dicyclopentadienyliron, are versatile additives, showing special promise in the promotion of the smokeless combustion of fuels. They are also antiknock agents in internal combustion engines. These substances, however, present difficulties in their analysis, particularly by infrared absorption methods. The Air Force has found X-ray diffraction ideally suited to the detection and quantitative determinion of some 23 solid crystalline ferrocenes, whose chemical similarities made infrared techniques unsuitable.

The trend towards increasingly higher-temperature turboprop and turbojet aircraft necessitates lubricants that are more resistant to pyrolysis and oxidation than even the diesters now commonly used. This requirement has been the incentive of research by the Naval Research Laboratory into lubricants made from aromatic acids and fluoroalcohols. Esters of conjugated ring acids, such as the diphenates, and fluoroalcohols offer more resistance to oxidation than corresponding esters of aliphatic acids. Both phenyl-substituted aliphatic acids and diphenates were studied, the latter showing greater promise.

SYNTHETIC RUBBERS AND PLASTICS

Several years ago the announcement was made that isoprene could be polymerized in such a way that all molecules were cis-1, 4 polyisoprene, which is the structure of natural rubber. Several companies are now announcing plans for plants which are expected to be operative within one or two years. This is the most outstanding example of a new and quite general technique of what has been called "fixing polymer molecules in space." The specific properties of natural gutta-percha, which is hard and tough, and is considered to be of the trans-1,4-polyisoprene type, have been duplicated by a synthetic polymer of isoprene of the same structure. Linear polyethylene is being made by a number of companies. Several kinds of plastics, through polymerization of the stereospecific type, have been made with melting points far higher than the original amorphous varieties. The selection of catalysts and the relation between the entering monomer and the structure of the chain to which addition takes place appear to be determining factors in the new technique.

The chemical resistance and thermal stability of a new fluorocarbon elastomer developed for the Quartermaster Corps of the Army have recently been evaluated and the results released in a recent publication. The material is a copolymer of vinylidene fluoride and perfluoropropene. It has been compared with an older standard fluorocarbon elastomer and found quite comparable, and in some cases superior, depending on the method of cure of each. Both materials were cured with a peroxide, an amine, and a new agent of the carbamate type. Tests were made by exposure for 5 hours and 70 hours to air, motor oil, diester oil, silicate ester oil, and isooctane-toluene test fluid at various temperatures. Both polymers showed good resistance to red fuming nitric acid.

A thorough investigation is reported by the Air Force of copolymerization of dihydroperfluorobutyl acrylate with a number of other monomers from such general classes as 1,3 dienes, unsaturated acids, acrylamides, haloacrylates, vinyl alkyl ethers, vinyl silanes, and allyl esters of unsaturated acids. Promising copolymers are being compounded and evaluation data obtained. The behavior of 1,1-dihydroperfluorobutyl acrylate has thus been fully explored in connection with the search for potentially valuable polymers based on this important new monomer, and preliminary investigations have been made of many copolymer compositions not previously studied.

Spheres varying from ⅛ to ½ inch in diameter made of active alumina are now being manufactured, and function largely as very effective adsorbents of moisture in

(Continued on page 35)

Specialist!

This handsome fellow specializes in "inside jobs." He's the corn borer. He may not be the ugliest insect known to Agriculture, but the damage he inflicts ranks him right up there with the worst.

One fact remains very clear. The corn borer and his flying, crawling, burrowing and hopping "cousins" still get too large a share of Agricultural production.

Only through continuing research and experimentation can we hope to win the vigorous battle with the insect world. Shell Chemical Corporation, with the valuable co-operation of independent entomologists, U.S.D.A. staff researchers, extension workers and growers, strives to develop better and more successful pesticides to reduce crop losses.

Modern Shell pesticides, now in use as a result of this close co-operation, include aldrin, dieldrin, endrin, Methyl Parathion and Phosdrin® insecticides; D-D® and Nemagon® Soil Fumigants and Allyl Alcohol weed seed killer.

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"IMPROVED MANPOWER UTILIZATION"

The U.S. Army Chemical Corps Training Command applies work measurement to a Chemical Processing Company and increases production 45% with only a 2% increase in personnel.

By

1ST LT. ROBERT D. ALTER

Management Analyst
U.S. Army Chemical Corps Training Command

DUE to the world situation it has become increasingly apparent that each member of the Armed Forces of the United States must be utilized to the fullest possible extent. To insure maximum utilization of its available manpower, the Department of the Army has directed the technical services to conduct work measurement studies of their Table of Organization and Equipment (TOE) service companies.

In implementing its part in the Department of the Army program, the U.S. Army Chemical Corps Training Command conducted a work measurement analysis on a Chemical Processing Company. This Company is well suited for analysis by work measurement techniques because its work is largely machine paced.

A Processing Company has the mission of impregnating clothing with chemicals so that the clothing will offer the wearer protection against the effects of blister gases.

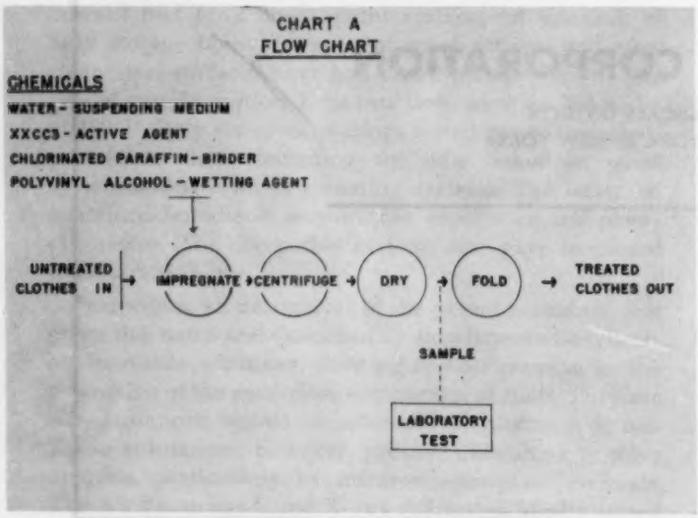
The process used to impregnate the clothing is called the M2 water suspension process. Flow Chart A shows the essential elements of the process.

The Processing Company is composed of two platoons and each platoon operates one complete plant. The plant is operated with two 10-hour shifts per day and requires one section per shift. The platoon organization is shown in Chart B, column 1.

To do its job the processing plant is equipped with two concentrate tanks, three suspension tanks, an impregnator-centrifuger, two dryers, a 10-horsepower steam boiler, two 30-kilowatt electric generators, and a laboratory. A typical layout of the plant is shown in Chart C.

In plant operations, the solution tank operator mixes the chemicals into a concentrate and then, with the help of the laboratory specialist, dilutes the concentrate into a working suspension. The impregnaor operator loads the impregnator with 150 pounds of clothes and pumps in 150 gallons of working suspension. The clothes are soaked for approximately 6 minutes, the impregnator is drained, and the clothing is centrifuged. The clothes are than removed from the impregnator and placed in a dryer. After drying, the clothes are folded, bundled, and a sample of the cloth is given to the laboratory specialist for quality testing.

CHART A
FLOW CHART



Early in 1957 the Chemical Corps Training Command conducted the first of two work measurement tests on a Chemical Processing Company. This test indicated that plant production was limited by the drying time, and that the addition of a dryer to the components of the plant would increase production by 30 to 50 per cent without increasing personnel. To determine the actual production increase and any changes required in TOE personnel and/or equipment, the Chemical Corps Training Command in August 1958 added an extra dryer to the processing plant of the 317th Chemical Processing Company and conducted a second test. This follow-up test was designed to answer the following questions:

1. *Plant Capacity*—Will there be enough capacity in the existing steam and electric generating equipment to sustain the increased load of a third dryer?

2. *Plant Production*—What will be the machine utilization and how much will the production increase when using the extra dryer?

3. *Plant Personnel*—How will the personnel be affected by the increased production and will any additional personnel be necessary?

The questions on plant capacity were studied by using appropriate engineering techniques. The questions on plant production and plant personnel were studied by the use of a work sampling study and man-machine charts supplemented with time studies.

To determine if the existing steam boiler was capable of supporting the 50 per cent greater load of a third dryer, two different techniques were used. One technique involved making a thermodynamic balance on the steam boiler. This technique started with an analysis of the flue gas which showed that the conversion of oil to heat was about 85 per cent efficient. Then, from the record of the fuel consumption, the temperature of the feed water, and the pressure of the steam, the approximate steam output was determined. This output was found to be 75 per cent of the rated capacity of the boiler. The second technique was based on the work sampling study and showed that the boiler was operating approximately 80 per cent of the time; or therefore, at 80 per cent of capacity. The two techniques arrived at estimations which are in close agreement and which indicate that the boiler is operating at less than capacity. It was concluded that the steam capacity of the existing plant is adequate to support the extra dryer.

The extra dryer adds about 25 per cent to the peak electric load on the electric generators. In plant operation the generators are synchronized and deliver 60 KW of power to the plant's 18 electric motors. In testing the electrical load of the plant, the starting and operating

Lt. Alter, born in Chicago in November, 1934, received B.S. degrees in both Mechanical Engineering and Business and Engineering Administration from Massachusetts Institute of Technology in June 1956. Following graduation he worked for 9 months as an Industrial Engineer in Work Simplification. In March 1957, he was commissioned in the USAR and called to active duty in the Chemical Corps. After completing the Chemical Corps Officers Basic Course and 10 months of troop duty, Lt. Alter was assigned to the Training Command Headquarters to conduct the Work Measurement Program.

currents of each of the 18 electric motors were measured separately. Peak loads of short duration were found to occur whenever a motor started or reversed. The majority of the operating and peak loads come from the motors in the impregnator and dryers. These motors reverse 3 times a minute. Starting the impregnator and three dryers simultaneously gave the maximum peak load which would be expected under normal operation. This load exceeds the rated capacity of the generators; however, the generators demonstrated that they are capable of sustaining this short duration load. The maximum possible overload would occur if all 18 motors were started simultaneously. This load was impractical to experiment with; and, as a substitute, one generator was operated under the equivalent overload and performed satisfactorily. It was concluded that the existing electric capacity is adequate to support the extra dryer.

The plant production is controlled by the slowest operation. The drying cycle takes 58 minutes per 150 pound load while three loads in the impregnator take a total of 54 minutes. Therefore, even with a third dryer the drying operation remained the slowest part of the process. The plant is operated in 2 shifts of 10 hours per day, 26 days per month or 520 hours per month. The work sampling study indicated that the dryers were being utilized 95 per cent of the operating time. Therefore, the production was calculated to be 230,000 pounds of clothes per month.

$$\frac{3 \text{ dryers}}{\text{Plant}} \times \frac{60 \text{min/hr}}{58 \text{min/load}} \times \frac{150 \text{ lbs.}}{\text{dryer-load}} \times \frac{520 \text{ hr}}{\text{month}} \times \frac{95}{100} = \frac{230{,}000 \text{ pounds}}{\text{plant-month}}$$

This operating schedule allows 4 hours per day which can be used for preventive maintenance. In addition a 1-hour allowance per day was added to account for the time when breakdowns would cause production to stop or lag. This one hour per day is based on the 5 per cent breakdown time shown in the Army's Field Engineering Acceptance Test of the original plant. Allowing for breakdown time, production will be approximately 220,000 pounds of clothes per platoon month when using three dryers, compared to approximately 150,000 pounds of clothes per platoon month when using only two dryers.

The increased production means an increased workload for the plant personnel. Most of the jobs in the plant are machine-paced and require one or two men to operate a machine or a group of machines. In these machine-paced jobs the men had sufficient time to absorb the additional workload. The increased workload had a different effect on the jobs that were not machine paced. In order to keep up with the increased quality control testing it was found necessary to have two laboratory specialists per section instead of one. The work sampling and time studies showed that only three folder-sorters are necessary to keep up with the folding and sorting workload. The minimum staff of direct workers required to operate one shift in the modified plant is as follows:

JOB	*NR OF MEN*
Laboratory Specialists	2
Solution Tank Operators	2
Impregnator Operators	2
Dryer Operators	2
Folder-sorters	3
Engine Operator	1
Total Per Shift	12

In order to accomplish its mission a military unit should have sufficient personnel to allow for casualties, KP details, guard details, etc. Therefore, to keep the processing plant operating at full production, it is necessary to add 25 per cent more personnel or 3 men to the minimum staff. Two folder-sorters and one working supervisor (assistant foreman) per section are added. This allows two soldiers to take over the duties of an operator helper, and also allows a trained man to take over the duties of

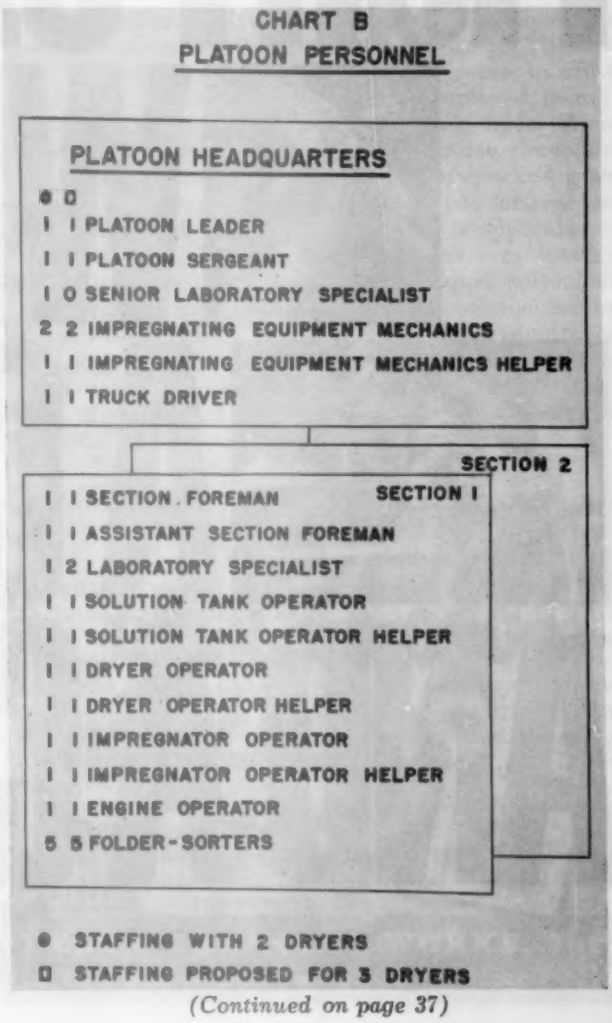


CHART B
PLATOON PERSONNEL
PLATOON HEADQUARTERS
● □
1 1 PLATOON LEADER
1 1 PLATOON SERGEANT
1 0 SENIOR LABORATORY SPECIALIST
2 2 IMPREGNATING EQUIPMENT MECHANICS
1 1 IMPREGNATING EQUIPMENT MECHANICS HELPER
1 1 TRUCK DRIVER
SECTION 2
SECTION 1
1 1 SECTION FOREMAN
1 1 ASSISTANT SECTION FOREMAN
1 2 LABORATORY SPECIALIST
1 1 SOLUTION TANK OPERATOR
1 1 SOLUTION TANK OPERATOR HELPER
1 1 DRYER OPERATOR
1 1 DRYER OPERATOR HELPER
1 1 IMPREGNATOR OPERATOR
1 1 IMPREGNATOR OPERATOR HELPER
1 1 ENGINE OPERATOR
5 5 FOLDER-SORTERS
● STAFFING WITH 2 DRYERS
□ STAFFING PROPOSED FOR 3 DRYERS

(Continued on page 37)

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DEFENSE CHEMISTRY IN THE NEWS

(Continued from page 30)

drying fluids of all types. The spheres are thermally stable, have large surface area, and are quite pure chemically. They also resist abrasion and may be repeatedly regenerated. Beta trihydrate is calcined under carefully controlled conditions to include only the most desirable components, eta alumina and alpha monohydrate.

BIOCHEMICAL ADVANCES

After three years of intensive research, a tetracycline antibiotic has been synthesized that is identical with a material made by partial degradation of a fermentation product. The process starts with *p*-chloro-*m*-cresol, and requires twenty four separate transformations. The only difference between the synthetic material and that derived from natural sources is that the former is racemic rather than dextrorotatory. No immediate return is expected in the way of commercial production, but the research has great value in proving the structure of this type of antibiotics, and in determining how they act in animals. The discovery may also lead to new products made by synthetic methods and to simpler derivatives containing elements of the tetracycline structure.

A disturbing factor in the use of penicillin antibotics is the immunity which various pathogenic organisms are developing to various derivatives. A recent announcement has been made that British chemists have isolated from fermentation products a substance which appears to be a basic molecule in the penicillin series, and from which a large number of new antibiotics may be made. Some of these may defy the immunological processes of microorganisms. The discovery, however, still remains in the domain of basic research, and practical applications have not as yet been found.

The production and control of artificial atmospheres for living organisms have been covered in a bibliography of unclassified references to world literature prepared for the Air Force. The fields covered include human biology and medicine, microbiology, botany, and zoology. Among the topics in this bibliography are the following: carbon dioxide effects and removal; electromagnetic radiation including cosmic; variation of G forces; temperature regulation; all phases of oxygen generation and pressure; decompression factors; sealed cabins or containers; toxic substances; water and moisture control; and miscellaneous factors.

The Office of Naval Research recently sponsored a meeting of psychologists, pharmacologists, biochemists, and psychiatrists to consider the effects of drugs on human performance. These scientists reviewed and discussed problems associated with maintaining and enhancing human performance under normal and stressful conditions. The published symposium discussions are accompaned by a bibliography of annotated references prepared for the participants.

PREVENTION OF DETERIORATION

A report has been issued by the Quartermaster Corps of the Army on the results of four years storage of a great variety of material in some 59 outdoor units by the cocooning techniques employed at the close of World War II for ships, locomotives, and guns. The study was undertaken to provide outdoor storage when indoor storage structures are not available. Of the original units, 36 withstood weather for four years without damage to their contents. The remaining 23 were disassembled as defects appeared, and causes of their failure were determined. Two types of structures were finally selected as best adapted to this type of storage. In general a unit has a wooden floor covered with barrier material and is raised to permit ventilation, and wooden framing with prefabricated wood and masonite panels, over which a variety of sheeting material was stretched. The three types of sprayed coatings applied in succession included a vinyl material, an asphalt cut-back material, and an aluminum pigmented outer coat.

A study by the Air Force of fungus resistance provided for cotton parachute webbings stored in a subarctic climate has indicated that the concentration of copper-8-quinolinolate required for protection should be of the order of 0.14% of copper, based on the dry weight of the treated material. This would amount to 0.83% of the fungicide on the same basis. An equally acceptable preservative material, used in slightly greater amounts, was dihydroxy-dichloro-diphenyl methane. Water repellants added to the basic fungicidal formulations gave somewhat improved fungus resistance.

Two significant advances in the field of leather have been announced by the Quartermaster Corps. The first has to do with a new and rapid tanning process in which common and abundant aldehydes are employed, including formaldehyde, glyoxal, and glutaraldehyde. These chemicals are used in connection with chrome, zirconium, and vegetable tannages. The danger of cracked grain that has heretofore characterized aldehyde tannage has been eliminated, and the new process is applicable to heavy leathers. The second process involves treating glove and shoe upper leathers with liquid polysulfide polymers, which are applied to form a protective barrier in the leather. A high degree of resistance to penetration or absorption of petroleum chemicals, liquid chemicals, and water is developed in leathers so treated. The flexibility of the leather is unimpaired, and the flesh side is still able to absorb perspiration.

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R.O.T.C. AWARD PROGRAM

(Continued from page 7)

ments for the degree of Bachelor of Science in Chemical Engineering at the University of Illinois and was sworn into the Army on 11 August 1956. I took a permanent position as Process Engineer for Texaco at their refinery at Lawrenceville, Illinois, on 13 August 1956. About the middle of the next month I accepted a Purdue University Fellowship to work for the Master of Science degree in Chemical Engineering, at Purdue University.

"I took an educational leave of absence from Texaco and went to graduate school at Purdue. I completed the work for the Master of Science degree in June 1957, and returned to Texaco and the Process Engineering Department immediately thereafter. I worked for Texaco until 8 January 1958, and reported at Fort Belvoir, Virginia, on 16 January 1958, to attend the Engineer Officer Basic Course. . . .

"I am presently a Platoon Leader in Company "B" of the 20th Engineer Battalion (Combat) (Army) in the 937th Engr Group. Most of my work here has been typical engineer type work with the emphasis on road construction. . . .

"I expect to be stationed here at Fort Campbell, until I complete my tour of duty, 13 January, 1960. Leaving the Army, I plan on returning to my work at Texaco. . . ."

(Mr. Childress recently attended the CBR School of the 101st Airborne Division at Fort Campbell, Kentucky.)

JIMMY DALE MAY

Army—Agricultural and Mechanical College of Texas, College Station, Texas. Award Winner in 1954

". . . Following my junior year in college, I worked for the Baytown Refinery of Humble Oil and Refining Company during the summer. I worked in their Technical Service Group. During that summer I also attended ROTC summer camp at Fort McClellan, Alabama. . . .

"Upon receiving my B.S. Degree in Chemical Engineering and commission in May, 1955, I went to work for Union Carbide Chemicals Company in Texas City, Texas. I worked in a production unit there. On January 1, 1956, I was transferred to Union Carbide Chemicals Company's plant here in Torrance, California. I continued working in a production unit until May, 1957, when I entered the Service under the RFA program for six months. I attended the Basic Officers' Course at Fort McClellan, Alabama. I graduated from school second place in my class. Upon completion of this course I was assigned to the S-3 of the 100th Cml Gp (Com Z).

"As of now, I am assigned to a control group here in California. There is no reserve unit available for me. Since my return from the service I have been working in our Engineering and Development Department here in Torrance. . . .

"As to community and civic activities, I am most active in my church. I am now a Sunday School teacher and hold an office in several other church groups. For the first time since becoming 21 I was able to exercise my right of voting during the recent gubernatorial and senatorial election. . . ."

GERALD P. ZIEMBA

Air Force—University of Detroit, Detroit, Michigan. Award Winner in 1957

". . . Immediately after graduation (1957) I took a position with the Linde Company, Division of Union Carbide Corporation, as a sales trainee in their Detroit District Sales Office. I was with the company only three weeks and then attended R.O.T.C. Summer Camp at Fort Campbell, Kentucky, for six weeks from June to August, 1957, where I received my Second Lieutenant commission in the United States Army Reserves. I returned in August to the Linde Company and stayed on their sales force in training until March 31, 1958. On April 1, 1958, I transferred to another Division of Union Carbide Corporation, the Union Carbide Chemicals Company. Here I assumed a position as a Sales Correspondent in their New York General Sales Office. I have been at this same position since that date.

"On April 12, 1959, I am scheduled to go on active duty as a Second Lieutenant in the Chemical Corps in the United States Army Reserves. . . ."

LT. MARVIN E. ELLIS, JR.

Army—Georgia Institute of Technology, Atlanta, Georgia. Award Winner in 1954

Now First Lieutenant, on duty at Chemical Warfare Laboratories, Army Chemical Center, Maryland, Lt. Ellis summarized his experience since receiving the award at Georgia Tech in 1954 as follows:

Date	*Event*
September 1955	Graduation from Georgia Tech B.S.—Chemical Engineering
Sep 1955—Jun 1957	Graduate studies at Penn State M.S.—Chemical Engineering
Jun 1957—Jan 1958	Executive Training — Publisher Levittown Times-Bristol Courier Levittown, Pennsylvania
Jan 1958—Apr 1958	Officers Basic Class U. S. Army Chemical Corps School, Ft. McClellan, Alabama
Apr 1958—Jan 1959	Process Design Engineer, U.S. Army Chemical Warfare Labs, Army Chemical Center, Maryland
Jan 1959—Mar 1959	Assistant Executive Officer, U.S. Army Chemical Warfare Labs, Army Chemical Center, Maryland

In a number of the letters from officials of these universities and colleges received by Mr. Johnson, there are interesting remarks expressing appreciation of this A.F.C.A. program. Herewith are extracts from some of these letters:

Mississippi State University, School of Arts and Sciences. State College, Mississippi—Department of Chemistry.

". . certainly we should like to assure you of our genuine appreciation of the opportunities of cooperating with the Armed Forces Chemical Association." (Signed M. P. Etheredge, Dean)

University of Colorado, Boulder, Colorado. Office of the Professor of Military Science and Tactics.

". . . Your interest in following and reporting the activities of R.O.T.C. recipients of your A.F.C.A. Award are, I am certain, appreciated by all concerned." (Signed R. P. West, Colonel, CE PMST)

Idaho State College, Department of Military Science and Tactics, Pocatello, Idaho.

". . . Thank you for your continued interest in graduates of Idaho State College." (Signed H. P. Rimmer, Lt. Col. Artillery, PMST)

North Carolina State College of Agriculture and Engineering. Department of Military Science and Tactics, Raleigh, North Carolina.

". . . We are indeed pleased with your interest in R.O.T.C. students and the R.O.T.C. program. . . . (Signed L. W. Merriam, Colonel Infantry, PMST)

University of Oklahoma, Office of the Dean of Students, Norman, Oklahoma.

". . . We appreciate your interest in our R.O.T.C. students specializing in chemistry and the allied sciences, and it is hoped that the above information will enable you to contact the men personally as to their activities since leaving the University." (Signed Clifford J. Craven, Dean of Students.)

Vanderbilt University, Department of Military Science and Tactics, Nashville, Tennessee.

". . . Your interest in the R.O.T.C. program is greatly appreciated and if I can be of further assistance please feel free to contact me." (Signed W. L. Gross, Major, Infantry, Asst. PMST.)

University of Detroit, Reserve Officers' Training Corps. U.S.A., Detroit, Michigan.

". . . I wish to express my appreciation for your interest in R.O.T.C. students . . ." (Signed Frank P. Dakan, Lt. Col. CE PMST)

VACCINE TO RETARD INFECTION OF WOUNDS IS TESTED AT ACC

WASHINGTON—An experimental vaccine tested by Army scientists may save thousands of lives in case of nuclear war.

Immunization with the vaccine, according to an Army Chemical Corps researcher, would slow the development of death-dealing bacteria usually found in massive open wounds, such as an atomic blast would produce.

Lt. Col. Douglas Lindsey, deputy director of medical research at the Chemical Warfare Laboratories, Army Chemical Center, Maryland, described the studies now in progress to the Armed Forces Commission on Immunization recently in session here.

In a mass casualty situation, it was pointed out that medical facilities would be swamped and countless injured would possibly die from the fast-acting infection while waiting for surgical attention, even though the wound were to a non-vital part of the body, such as a leg or arm.

However, the Army Chemical Center studies have indicated that a routine immunization against the infectious organisms may as much as double the median survival time for victims of massive wounds.

Though all of the work to date has been performed on animals, Col. Lindsey expects the vaccine, when perfected, to be fully applicable to humans.

MANPOWER UTILIZATION

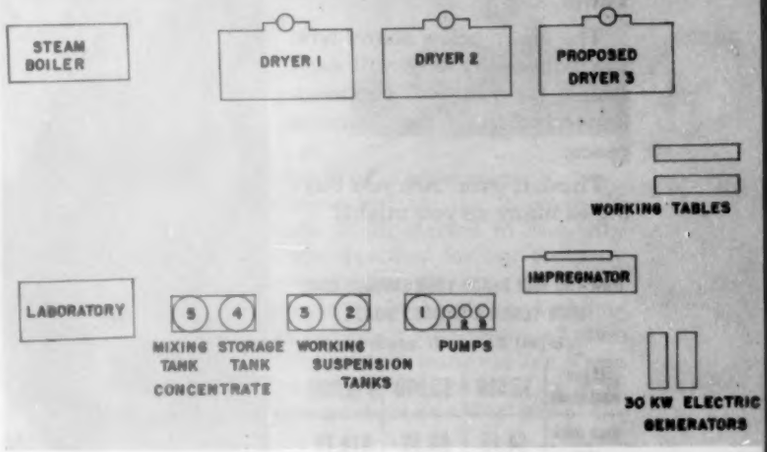
(Continued from page 33)

any of the trained operators. There will be 15 direct workers and one supervisor of 16 men per section. The final staffing of a section becomes the same as before with the addition of one laboratory specialist per section (See Chart B).

The work measurement test demonstrated that a Processing Company utilizing the modified plant and 95 men can process 440,000 pounds of clothing per month as compared to the present company of 93 men processing 300,000 pounds of clothing per month. This represents a 45 per cent increase in production with only a 2 per cent increase in personnel. The Work Measurement Program is one of the ways in which the U.S. Army Chemical Corps Training Command is striving to make the Army more efficient and better prepared to accomplish its mission.

CHART C

PLANT LAYOUT



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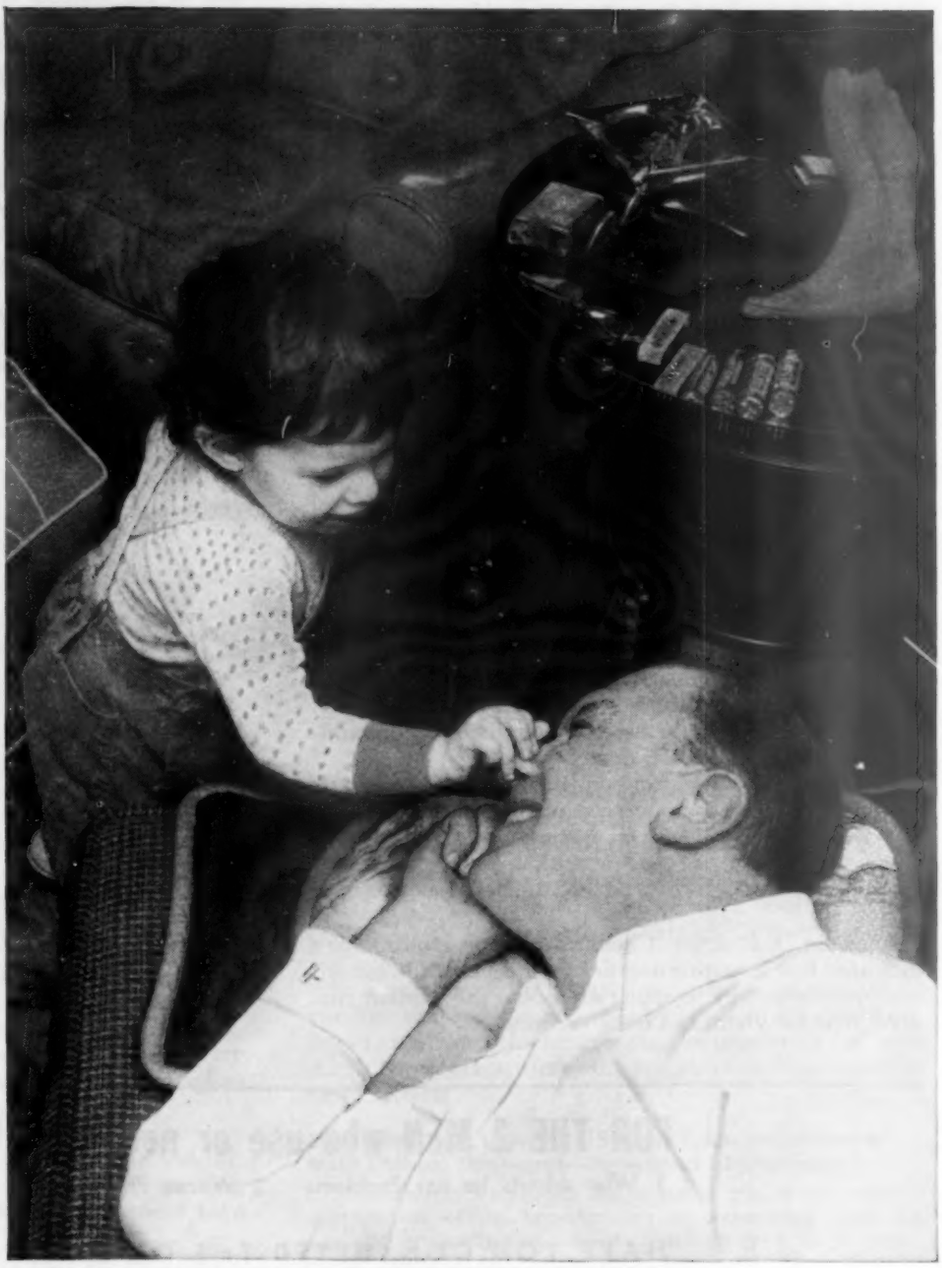

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CHEMICAL CORPS NEWS

EXTENSIVE PROGRAM CONDUCTED FOR CHEMICAL STAFF OFFICERS

FORT McCLELLAN, ALA.—Senior staff chemical officers from the Continental United States, Europe, Alaska, Panama, Hawaii, and Korea, also commanders of major Chemical Corps activities and representatives of the Joint Chiefs of Staff attended the U.S. Army Staff Chemical Officers First Annual Conference held at the Chemical Corps Training Command, Fort McClellan, Alabama, November 17-21, 1958.

The many changes in the National Defense program, including the reorganization of the Department of Defense and the recently clarified responsibilities of the Chemical Corps in radiological defense, presented the need for such a conference. In conjunction with the radiological defense responsibilities, information regarding the new Nuclear Effects Advisors Course and the Radiological Safety Courses taught at the Chemical Corps School was included in the agenda.

The main purposes of the conference were to (1) inform the conferees of advances in the Chemical, Biological, and Radiological field, (2) provide an opportunity for the conferees to discuss the problems they encounter in the field and to seek solutions through a mutual exchange of ideas, and (3) to participate in the Chief Chemical Officer's Monthly Command and Staff Conference which was conducted by Major General Marshall Stubbs on November 20 at Fort McClellan.

Presentations were made by all commands and activities of the Chemical Corps; Chemical Corps representatives in Headquarters, Department of the Army, USCONARC, and the Field Armies; and by a Joint Chiefs of Staff representative.

The program included a skit on operation of the Radiological Center; a training aids exhibit, and a classroom demonstration of the Army Fallout Prediction method utilizing the School-developed Fallout Prediction Model. There was also a demonstration in the field and a tour through the School's Radiological Laboratory.

The conferees included Col. Robert W. Breaks, of Hq, USCONARC; Col. William M. Howard, Second Army; Col. John D. Tolman, Third Army; Col. R. Beverly Caldwell, Fourth Army; Col. Walter W. Kuehler, Fifth Army; Col. Vincent F. Lapiana, Sixth Army; and Col. Thomas H. Magness, Military District of Washington.

From overseas commands there were Col. Sam Efnor, Jr., Seventh Army; Col. Nelson I. Decker, en route to Hq. Eighth Army; Col. Donald D. Bodé, U.S. Army, Europe; Col. Maurice Peerenboom, USARPAC; Col. Joseph F. Escude, USARCARIB; Lt. Col. Charles S. Brice, Jr., SHAPE; Lt. Col. John Moran, Hawaii; Lt. Col. Levin B. Cottingham, USARCOMZ, Europe; and Lt. Col. Martin L. Denlinger, Alaska.

LADY SHARPSHOOTER COMMANDS WAC DETACHMENT AT CML. CENTER

EDGEWOOD, MD.—It's a wonder they didn't put her in the Infantry.

Six months after First Lieutenant Claire Archambault first picked up a rifle, she was crowned Women's National Service Rifle Champion in the 1958 matches at Camp Perry, Ohio.

This latter-day Annie Oakley, a native of West Warwick, R. I., arrived last March to take command of the Army Chemical Center WAC Detachment.

Success on the range came fast for the 27-year-old Boston University graduate. It all started in February 1958 when she tried out and qualified for her company rifle team at Fort Leavenworth, Kansas.

Now the story picks up steam. In April, Lt. Archambault joined the Fort Leavenworth rifle team—all men but her—and was promptly named team captain. Soon afterwards, when the Leavenworth team fired in Fifth Army competition, she was retained as a member of the Fifth Army squad.

And in August, in the nation-wide Camp Perry matches, the sharpshooting lieutenant topped a field of more than 25 women—two of them former national champions—to win national women's laurels with the Army's M-1 rifle.

How did she do it, with a scant six months' experience?

"I think it was due to good instruction and sheer determination," Lt. Archambault explains. "Physical ability isn't really too important. There are a lot of little 60-year-old ladies who make good scores with the M-1. I have very poor eyesight myself, and I wear glasses all the time, even when I'm firing."

Lt. Archambault followed up her undergraduate work at Boston University by taking a degree at the University's School of Law. She comes to Army Chemical Center from Fort Leavenworth, where she served as claims and boards officer.

BARRACKS AT McCLELLAN NAMED IN HONOR OF MASTER SGT. HARMON

FORT McCLELLAN, ALA.—Soon after the U.S. Army Chemical Corps School Support Battalion's Student Enlisted Company barracks (picture herewith) was designated "Harmon Barracks," memorializing the name of MSGT David C. Harmon, Col. John M. Palmer, Training Command Commanding Officer, received a very appreciative letter from the late sergeant's widow.

Mrs. Harmon expressed gratitude and pleasure for the giving of her husband's name to the building which houses young men just starting their Army careers; and also indicated a hope that Harmon Barracks will be the happiest living quarters in the Army.

MSGT Harmon, as a member of the Chemical Section of the 101st Airborne Division, parachuted into France on D-Day, 6 June 1944. Landing far from the drop zone he led a group of men back to his unit. For his heroism in fighting his way back through German positions he was awarded the Silver Star.

During the ceremony in which he received his award on 23 June 1944, he was wounded by enemy artillery fire, recovered from his wounds, and later jumped again with the 101st.

MSGT David C. Harmon died on 10 December 1944.

COL. FELLENZ HONORED

Colonel Lloyd E. Fellenz, recently assigned to duty in Washington, D.C. following a tour as Commanding Officer of the Chemical Warfare Laboratories, Army Chemical Center, Maryland, has been awarded a second Oak Leaf Cluster to the Army Commendation Ribbon. The citation reads in part: "Through his outstanding leadership, the U.S. Army Chemical Warfare Laboratories attained a more renowned position as an international authority in the chemical research and development program. . . ."

The presentation was made by Brig. Gen. Graydon C. Essman, Chief of Chemical Research and Development.

CIVILIAN AWARDS

Six civilian employees in the Office of the Chief Chemical Officer were recently presented Department of the Army Awards plus cash. They were: *Miss Agnes C. Gianoly*—Outstanding Performance Rating; *Mrs. Pauline E. Lambert*—Outstanding Performance Rating; *Mr. Francis H. McKay, Jr.*—Department of the Army Performance Award Certificate; *Mr. Charles W. Lombard*—Certificate of Achievement; *Mr. Keith E. Nelson*—Sustained Superior Performance; and *Miss Helen M. O'Heir*—Sustained Superior Performance.

THE HISTORICAL CORNER

By DR. BROOKS E. KLEBER
U. S. Army Chemical Corps, Historical Office

THE CAPUA ARSENAL OF THE 12TH CHEMICAL MAINTENANCE COMPANY

The nineteen chemical maintenance companies which served overseas during World War II were responsible for third and fourth echelon maintenance of chemical warfare equipment and materiel. Unlike some CWS service-type units, maintenance companies were regularly employed in their primary mission. One of the most outstanding units of this type was the 12th Chemical Maintenance Company which served in North Africa, Italy, France, and Germany.

In November 1943, while in Italy, the Weapons Repair Section of the 12th Company took over the Royal Italian Arsenal at Capua which had been wrecked and abandoned by the retreating Germans. The Fifth U.S. Army needed this facility particularly to cope with a serious maintenance problem involving the 4.2-inch chemical mortar. The severe fighting in Italy had placed heavy demands on the chemical motar battalions. The exigencies of combat forced infantry commanders to request missions at ranges far in excess of the capabilities of the mortar, and, as a consequence, breakage of the weapon was heavy. The situation was further complicated by a shortage of spare parts for the chemical mortar. Manufacture as well as repair of mortar parts was needed to keep the mortar battalions equipped, and this demand exceeded the normal capabilities of a chemical maintenance unit.

The 12th Chemical Maintenance Company rehabilitated the arsenal, repairing and acquiring enough equipment to set up a foundry and machine shop. It was said that the overall facilities rivalled a fully equipped Ordnance maintenance company. Gathered at Capua, and operated by CWS personnel or skilled Italian workmen, were 12 lathes, 3 drill presses, 2 grinders, 3 planing mills, 3 shapers, 1 screw machine, and 1 power hacksaw. The international flavor of the facility was heightened by the orgin of manufacture of its machinery—Italian, American, and German.

Among other things, the foundry cast shock absorber slides for the chemical mortar which as the "Capua slide" earned a reputation for durability which surpassed the standard item. The machine shop turned out tube caps, springs, and forks for the mortar and a variety of other items—grenade projectors, nozzles, chains, worm gears. All of this was high quality materiel, produced at about one-third of the normal cost.

By August 1944, when the 12th Chemical Maintenance Company closed out its Italian operations in order to move on to southern France in support of the U.S. Seventh Army, the Capua arsenal had manufactured more than eighty different items of chemical warfare materiel. But its greatest service was to the mortar battalions. In the words of one Fifth Army document: "Had it not been for this supply of parts produced locally, chemical mortar units would not have had a full allowance of weapons much of the time."

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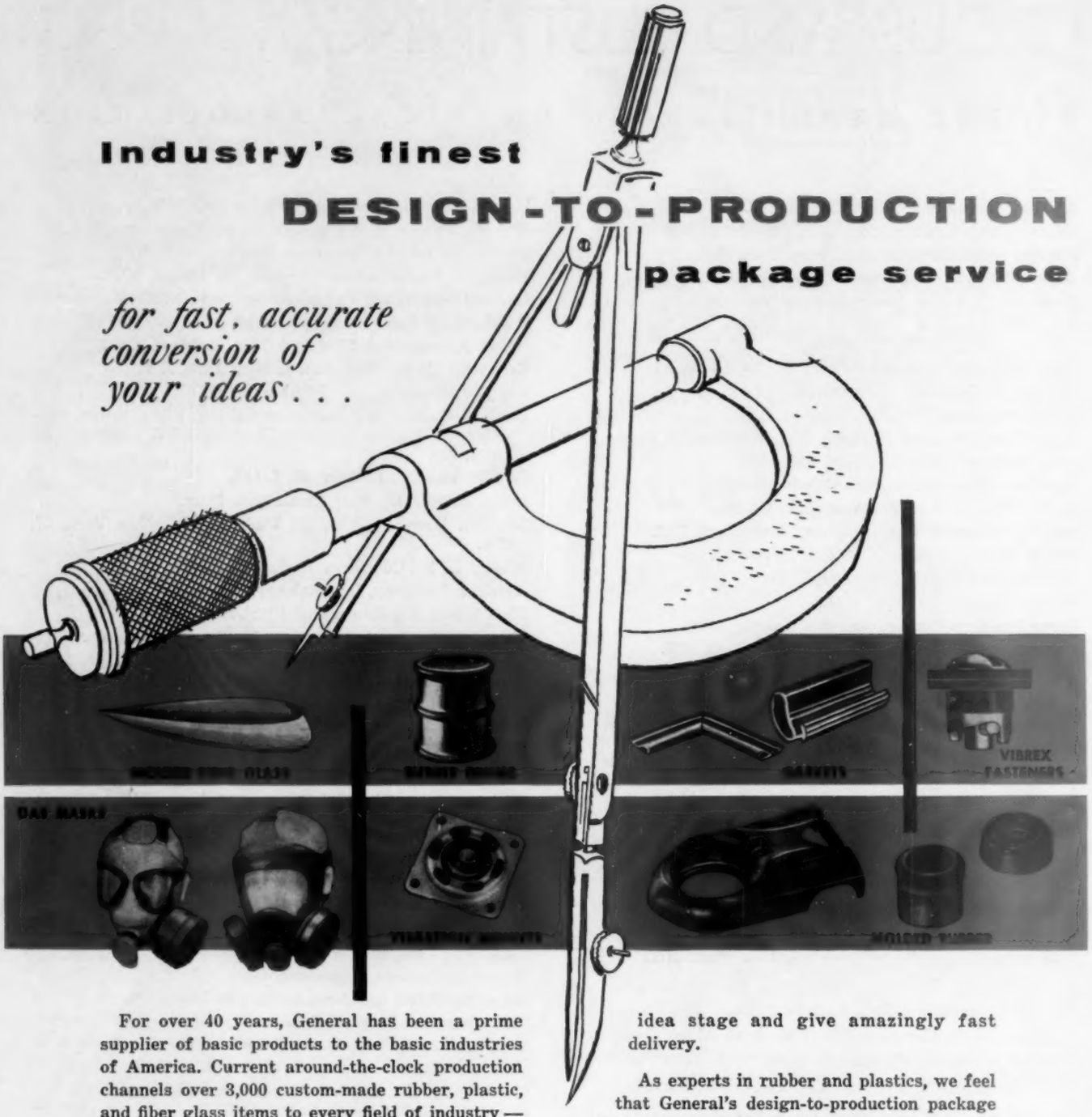

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